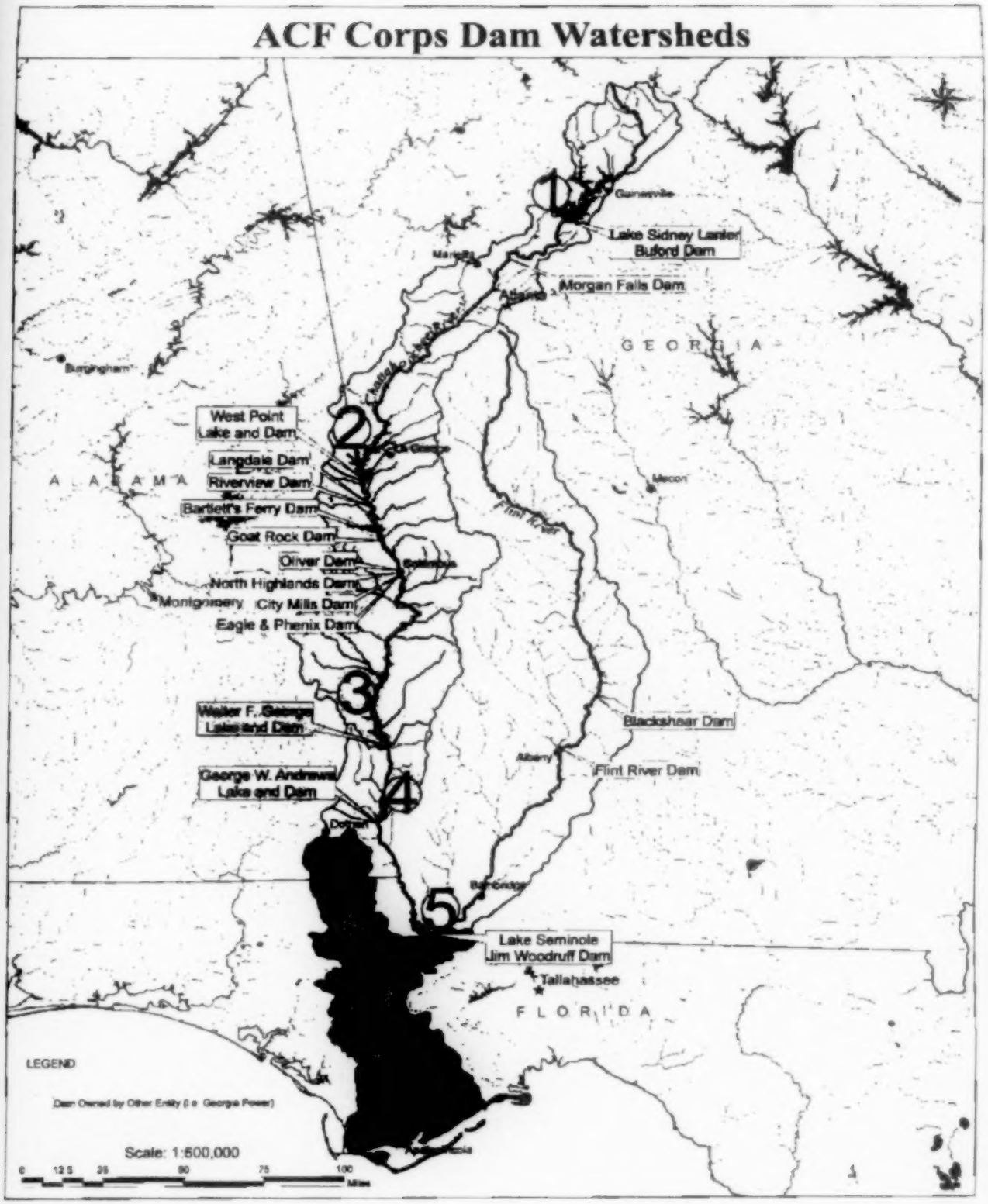
ACF Corps Dam Watersheds
Lake Sidney Lanier
Buford Dam
Morgan Falls Dam
GEORGIA
West Point
Lake and Dam
Langdale Dam
Riverview Dam
Bartlett's Ferry Dam
Goat Rock Dam
Oliver Dam
North Highlands Dam
City Mills Dam
Eagle & Phenix Dam
Walter F. George
Lake and Dam
George W. Andrews
Lake and Dam
Blackshear Dam
Flint River Dam
Lake Seminole
Jim Woodruff Dam
Tallahassee
FLORIDA
ALABAMA
Flint River
LEGEND
Dam Owned by Other Entity (i.e. Georgia Power)
Scale: 1:600,000
0 12.5 25 50 75 100
Miles

# BIOLOGICAL OPINION ON THE U.S. ARMY CORPS OF ENGINEERS, MOBILE DISTRICT, REVISED INTERIM OPERATING PLAN FOR JIM WOODRUFF DAM AND THE ASSOCIATED RELEASES TO THE APALACHICOLA RIVER

**Prepared by:**
**U.S. Fish and Wildlife Service**
**Panama City Field Office, Florida**
**May 22, 2012**

## EXECUTIVE SUMMARY

The action evaluated in this consultation is the Corps' Revised Interim Operating Plan (RIOP) for Jim Woodruff Dam, which describes releases from the dam to the Apalachicola River. Consultation on the RIOP was completed in 2008 and reinitiated in 2010, because of new information on the distribution and mortality of fat threeridge mussels. Substantial numbers of fat threeridge mussels recolonized habitats at elevations above the minimum 5,000 cfs flow, and many were subsequently exposed and killed when flows declined in September 2010. The Corps determined that the proposed RIOP may adversely affect the fat threeridge, purple bankclimber, and Chipola slabshell, and may affect but would not likely adversely affect (NLAA) the Gulf sturgeon or designated Gulf sturgeon or mussel critical habitat. The Service concurred with the Corps' determination of NLAA for the Gulf sturgeon and its designated critical habitat. Mussel effects were addressed in this biological opinion (BO).

The current version of the RIOP is very similar to the 2008 RIOP. It does not address operational specifics at the four federal reservoirs upstream of Woodruff. The

RIOP addresses two specific parameters of the daily releases from Woodruff Dam into the Apalachicola River: a minimum discharge in relation to average basin inflows (i.e., the actual amount of water flowing into all of the Corps projects during a given time period) and maximum fall rate (vertical drop in river stage per day). These two parameters vary by basin inflow, composite conservation storage level and by month. Except when basin inflow is less than 5,000 cfs and during some down-ramping periods, the minimum releases are not required to exceed basin inflow. The Corps proposed five modifications to the 2008 RIOP to minimize impacts to listed species: 1) volumetric balancing is eliminated; 2) minimum flow releases will match basin inflow between 5,000 and 10,000 cubic feet per second (cfs) from June through November (except during drought contingency operations); 3) drought contingency operations are not suspended until composite conservation storage has recovered above Zone 2 into Zone 1; 4) when releases are less than 10,000 cfs, the maximum fall rate is limited to 0.25 ft/day; and 5) river stage declines of 8 feet or more will not occur in less than 14 days when river flows are less than 40,000 cfs during the spawning season (March-May) under both normal and drought operations.

The current status of the three mussel species and their critical habitat is discussed in detail in the BO. Notable mortality of the purple bankclimber and fat threeridge has occurred during recent droughts in 2006-2008 and 2010-2012, but no Chipola slabshell mortality has been observed. The Chipola slabshell population is stable but generally occurs in relatively low abundance. The purple bankclimber is rare and occurs at low abundance in the Apalachicola River (with the exception of one location), and it appears to be experiencing poor recruit-

ment. The fat threeridge population appears stable and may be increasing in size. They are abundant in the middle reach of the Apalachicola River and the lower Chipola River, the population is relatively large, and there is evidence of recruitment.

Fat threeridge are likely moving in response to changing water levels to maintain an optimal depth or associated habitat parameter. At the time of the 2008 BO there were no listed mussels at river stages greater than 5,000 cfs due to the drought of 2006-2008. Although we noted that take may occur when individuals occupy stages greater than 5,000 cfs, we did not anticipate take under this scenario because it was considered an anomaly related to very high flows in 2005. However, based on recent data, it appears that fat threeridge readily recolonize higher bank elevations at flows greater than 5,000 cfs, where they could be at risk of stranding and mortality when flows decline. Mortality during these events was highest in the middle reach of the Apalachicola River where the main channel populations are the most abundant and slopes are shallow. Some mortality occurred in the Chipola River, but it appears to be limited. Mortality estimates from all of these events range from <1% to 2% depending on preceding hydrologic conditions, fall rates, habitat condition, and the size of the population in Swift Slough and unsurveyed deep-water habitats.

Relative to the Baseline period (1975-2008), the proposed RIOP provides both beneficial and adverse effects to the species and designated critical habitats we have assessed. Many of these effects derive from relatively minor differences between the RIOP and Baseline; however, we attribute these differences to changes in reservoir operations and not consumptive water use. Generally, it appears that the Corps would store water

more often and augment flows less often under the RIOP than has occurred historically. The RIOP uses some of this stored water to augment basin inflow in order to maintain a minimum flow of 5,000 cfs, but the frequency and duration of flows less than 10,000 cfs is increased.

Lower flows for longer durations will negatively impact all three mussel species. We expect impacts to Chipola slabshell to be minimal because it occurs almost entirely within the Chipola River where movement is facilitated by higher bank slopes and the species' probable tendency to move. Impacts to the purple bankclimber will also likely be minimized because this species appears to occur more often in deeper portions of the stream channel, which is likely why we have observed limited mortality during recent low flows. The results of the fat threeridge population viability analysis (PVA) indicate that the population can sustain reductions of 1-2% (estimated have occurred during recent droughts) if flows are reduced to 5,000 cfs and 4,500 cfs with currently projected probabilities. However, the PVA also indicates that increasing the frequency of such events results in a greater impact to population viability. The RIOP may affect three of the five primary constituent elements (PCEs) of mussel critical habitat: 1) permanently flowing water; 2) water quality; and 3) fish hosts. It does not appear to reduce the amount of important floodplain habitat available to fish hosts. Droughts substantially change the nature of all of these PCEs, but the RIOP would not appreciably change the quantity or quality of the PCEs to the extent that it would appreciably diminish the habitat's capability to provide the intended conservation role. Therefore, it is the Service's biological opinion that the proposed action: 1) will not jeopardize the continued existence of

the fat threeridge, purple bankclimber, and Chipola slabshell; and 2) will not destroy or adversely modify designated critical habitat for the fat threeridge, purple bankclimber, and Chipola slabshell.

The Incidental Take Statement issued exempts the Corps from "take" under the Endangered Species Act. During each of these events (flow reduction to 4,500 cfs, and exposure at stages >5,000 cfs following recolonization), a maximum the following may be exposed: 30 purple bankclimbers (60 total); three Chipola slabshell (six total); and 9,150 fat threeridge (18,300 total). Three mandatory reasonable and prudent measures are also included: 1) adaptive management; 2) maintenance of the Chattahoochee gage; and 3) monitoring.

This BO is effective for five years (May 22, 2017). No further consultation is needed unless the Corps operates Woodruff Dam in a way that is different from the RIOP, new information indicates that the RIOP may affect listed species to an extent not considered in the BO, or if more mussels or Gulf sturgeon are "taken" under the Corps' operations than anticipated.

* * *

[U.S. Department of the Interior letterhead]

May 22, 2012

Mr. Curtis Flakes
Chief, Planning and Environmental Division
U.S. Army Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628-0001

Dear Mr. Flakes:

This document is the Fish and Wildlife Service's (Service) biological opinion (BO) of the Revised Interim Operating Plan (RIOP) for Jim Woodruff Dam. The RIOP addresses water management operations at Jim Woodruff Dam and the associated releases to the Apalachicola River. This opinion is provided in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*) and provides considerations for provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq.*).

The U.S. Army Corps of Engineers (Corps) originally requested formal consultation on this action by letter dated April 15, 2008. At that time, the Corps determined that the RIOP may adversely affect the threatened Gulf sturgeon (*Acipenser oxyrinchus desotoi*), endangered fat threeridge mussel (*Amblema neislerii*), threatened purple bankclimber mussel (*Elliptoideus sloatianus*), threatened Chipola slabshell (*Elliptio chipolaensis*), and areas designated as critical habitat for the Gulf sturgeon and these mussels. In the June 1, 2008 BO, the Service determined that the RIOP would not jeopardize the continued existence of these species nor destroy or adversely modify their designated criti-

cal habitats. An Incidental Take Statement (ITS) and Reasonable and Prudent Measures (RPMs) were issued to minimize the impacts of incidental take on these species.

Consultation was reinitiated by letter dated November 17, 2010, because of new information on the distribution and mortality of fat threeridge mussels. Substantial numbers of fat threeridge mussels recolonized habitats at elevations above the minimum 5,000 cfs flow, and many were subsequently exposed and killed when flows declined in September 2010. Since that time, we have worked with your staff on potential modifications to the RIOP to minimize impacts to fat threeridge mussels (Corps 2011 and 2012). As described in your most recent amended biological assessment (BA), the Corps is proposing to adopt some of these modifications (Corps 2012). The Corps has determined that the proposed RIOP may adversely affect the fat threeridge, purple bankclimber, and Chipola slabshell, and may affect but would not likely adversely affect (NLAA) the Gulf sturgeon or designated Gulf sturgeon or mussel critical habitat.

Based on the information you provided in the 2012 BA and your supplementary letter on April 12, 2012, the Service concurs with the Corps' determination of NLAA for the Gulf sturgeon and its designated critical habitat. We do not expect take of Gulf sturgeon eggs and larvae to occur because the RIOP's fall rate provision prevents river stage declines of 8 feet or more in less than 14 days, which were expected to result in take in the 2008 BO. In addition, there is little, if any, change to the available amount of spawning habitat in the spring or fall or juvenile sturgeon habitat (using the surrogate measure for salinity in the bay of consecutive days with flows less than 16,000 cfs). The RIOP may

benefit spawning and juvenile habitat relative to the environmental baseline period (1975-2008) by generally providing: 1) more 30 day-continuous habitat in the known spawning depth range, and 2) a slight reduction in the maximum number of consecutive days of flows less than 16,000 cfs during October through March when Gulf sturgeon are using the bay, which may be associated with lower salinities preferred by juveniles. No further impacts to Gulf sturgeon resulting from the RIOP have been identified. Therefore, we will not discuss Gulf sturgeon further in this BO.

A total of 34 federally listed species are known to occur within the Apalachicola-Chattahoochee-Flint (ACF) River Basin, but effects of the proposed action are limited to those that depend primarily on riverine habitat. Except for the temporary waiver of winter drawdown requirements during drought conditions, the Corps would implement the RIOP within the constraints of the existing water control plans for the upstream reservoir projects, i.e., the RIOP would not change the top of the flood control pools, conservation pools, or the rule curves of the upstream projects. Therefore, the proposed action will have no effect or an insignificant effect (*i.e.*, any impacts should never reach the scale where take occurs) on all but the riverine- and estuarine-dependent species. Two species of sea turtles and the West Indian manatee may sometimes occur in Apalachicola Bay or the lower Apalachicola River; however, any effects of the proposed action to these species would be insignificant also, due to their low numbers and only occasional seasonal residence in the river and bay. Three of the 34 ACF listed species are freshwater mussels that do not occur in areas downstream of the Corps' ACF projects: the shiny-rayed pocketbook, Gulf moccasinshell, and oval pigtoe. The proposed action will

have no effect on these mussel species. Altogether, the proposed action will have either no effect or an insignificant effect on the species listed below; therefore, these species are not further discussed in this BO. No further consultation is necessary for these species unless the RIOP is subsequently modified in a manner that causes an effect to listed species or designated critical habitat or new information reveals the RIOP may affect listed species or designated critical habitat in a manner or to an extent not previously considered.

| |
|---|
| Frosted flatwoods salamander (*Ambystoma cingulatum*) |
| Reticulated flatwoods salamander (*Ambystoma bishopi*) |
| Loggerhead turtle (*Caretta caretta caretta*) |
| Eastern indigo snake (*Drymarchon corais couperi*) |
| Atlantic ridley (*Lepidochelys kempi*) |
| Piping plover (*Charadrius melodus*) |
| Wood stork (*Mycteria americana*) |
| Gray bat (*Myotis grisescens*) |
| Indiana bat (*Myotis sodalis*) |
| West Indian manatee (*Trichechus manatus*) |
| Shiny-rayed pocketbook (*Lampsilis subangulata*) |
| Gulf moccasinshell (*Medionidus penicillatus*) |
| Oval pigtoe (*Pleurobema pyriforme*) |
| Little amphianthus (*Amphianthus pusillus*) |
| Apalachicola rosemary (*Conradina glabra*) |
| Telephus spurge (*Euphorbia telephioides*) |
| Harper's beauty (*Harperocallis flava*) |
| Black-spored quillwort (*Isoetes melanospora*) |
| Pondberry (*Lindera melissifolia*) |
| White birds-in-a-nest (*Macbridea alba*) |
| Canby's dropwort (*Oxypolis canbyi*) |
| Godfrey's butterwort (*Pinguicula ionantha*) |
| Harperella (*Ptilimnium nodosum*) |

| |
|---|
| Chapman's rhododendron (*Rhododendron chapmanii*) |
| Michaux's sumac (*Rhus michauxii*) |
| Green pitcherplant (*Sarracenia oreophila*) |
| American chaffseed (*Schwalbea Americana*) |
| Florida skullcap (*Scutellaria floridana*) |
| Fringed campion (*Silene polypetala*) |
| Gentian pinkroot (*Spigelia gentianoides*) |
| Cooley meadowrue (*Thalictrum cooleyi*) |
| Florida torreya (*Torreya taxifolia*) |
| Relict trillium (*Trillium reliquum*) |
| Gulf sturgeon (*Acipenser oxyrinchus desotoi*) |

The RIOP is intended to govern the releases from Woodruff Dam until revised or replaced with a new Water Control Plan (WCP). The Corps will prepare a draft environmental impact statement for updated water control manuals for the ACF River Basin. We understand that the revision of the WCP may take up to five additional years; therefore, we have structured this opinion to evaluate the effects of the proposed action over the next five years.

This BO is based on numerous coordination meetings, clarifying letters, and conference calls between the Corps and the Service in recent months, as well as unpublished data in Service files, the experience of Service biologists, and an extensive literature search. It does not rely on the regulatory definition of destruction or adverse modification of critical habitat as set forth in the Code of Federal Regulations at 50 CFR § 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat. A complete administrative record is on file in the Panama City Field Office, Florida.

* * *

## BIOLOGICAL OPINION

This opinion supersedes the 2008 BO dated June 1, 2008, which addressed the effects of the Revised Interim Operating Plan (RIOP), because the 2008 RIOP has been amended during reinitiation of consultation. The Corps has described changes to the RIOP and its effects in the revised amended BA dated February 15, 2012. Where appropriate, we have incorporated their descriptions and analysis into this BO. This document also supersedes the 2008 ITS and associated RPMs.

## 1 DESCRIPTION OF PROPOSED ACTION

The action evaluated in this consultation is the Corps' RIOP for Jim Woodruff Dam, which describes releases from the dam to the Apalachicola River. The RIOP and modifications were formulated to address protection of endangered and threatened species and critical habitat in the Apalachicola River, manage reservoir storage for other project purposes, and meet drought-related contingencies. According to the Corps, the RIOP is not a new WCP for Woodruff Dam; it is a definition of ACF operations that is within the limits established by the existing ACF WCP except during defined drought conditions. It is our understanding that the RIOP is effective until it is revised or until the ACF WCP is formally updated, at which time the Corps would reinitiate consultation.

The Corps operates five dams in the ACF River Basin: (in downstream order) Buford, West Point, Walter F. George, George W. Andrews, and Jim Woodruff (Figure 1.A). All are located wholly on the Chattahoochee River arm of the basin except the downstream-most dam, Woodruff, which is located at the confluence of the Chattahoochee and Flint rivers and marks the up-

stream extent of the Apalachicola River. Andrews is a lock and dam without any appreciable water storage, and Lake Seminole has very limited storage capacity. Both are essentially operated as run-of-river reservoirs (i.e., what goes in comes out without being stored for any substantial amount of time). The impoundments of Buford, West Point, and Walter F. George dams, however, provide for combined conservation storage of approximately 1.6 million acre-feet, relative to the top of each reservoir's full summer pool and the bottom of the conservation pool, which is potentially available to support water management operations. For about half of its length, the Chattahoochee River forms the boundary between Georgia and Alabama. Lake Seminole straddles the boundary between Florida and the southwest corner of Georgia.

The Corps operates the ACF reservoirs as a system, and releases from Woodruff Dam reflect the downstream end-result of system-wide operations. The RIOP addresses specific parameters of the daily releases from Woodruff Dam into the Apalachicola River. The RIOP does not address operational specifics at the four federal reservoirs upstream of Woodruff or all aspects of the operations at Woodruff, other than to anticipate waivers from the winter pool rule curves at West Point and Walter F. George reservoirs during exceptional drought conditions. The RIOP specifies two parameters applicable to the daily releases from Woodruff: a minimum discharge in relation to average basin inflows (see definition below) and maximum fall rate (vertical drop in river stage [ft/day]). For purposes of this BO, we use data for both parameters that are collected by the USGS at gage number 02358000, "Apalachicola River at Chattahoochee, FL," which is located 0.6 mi downstream of Woodruff Dam. We refer to this

flow measurement point throughout the BO simply as the "Chattahoochee gage".

Basin inflow is defined as the amount of water that would flow by Woodruff Dam during a given time period if all of the Corps' reservoirs maintained a constant water surface elevation during that period. The Corps estimates basin inflow daily from a combination of river and reservoir level measurements, mathematical stage/volume/discharge relationships, and operating characteristics of the various water release structures of the dams. The RIOP uses a 7-day moving average of daily basin inflow calculations for daily release decisions. Basin inflow is not the natural or "unimpaired" flow of the basin at the site of Woodruff Dam, because it reflects the influences of reservoir evaporative losses, inter-basin water transfers, and consumptive water uses, such as municipal and industrial water supply and agricultural irrigation.

The proposed action includes five modifications to the 2008 RIOP: 1) the use of volumetric balancing is eliminated; 2) minimum flow releases will match basin inflow when basin inflow is between 5,000 and 10,000 cfs during the months of June through November (this provision is suspended during drought contingency operations); 3) drought contingency operations are not suspended and normal operations reinstituted until composite conservation storage has recovered above Zone 2 into Zone 1; 4) when releases are within powerhouse capacity (which is flows less than about 16,000 cfs) and less than 10,000 cfs, the maximum fall rate is limited to 0.25 ft/day; and 5) river stage declines of 8 feet or more will not occur in less than 14 days when river flows are less than 40,000 cfs during the spawning season (March-May) under both normal and drought operations. Pro-

visions of the proposed RIOP are described in detail below.

### 1.1 Action Area

Service regulations define "action area" as all areas affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR §402.02). Although the RIOP specifically addresses the releases from Woodruff Dam, the downstream-most project among the Corps' ACF reservoirs, these releases are accomplished through the collective operations of all of the Corps' ACF reservoirs. Therefore, the action area includes all aquatic habitats that are downstream of the Corps' upstream-most ACF project, Lake Lanier/Buford Dam, ending with and including Apalachicola Bay (Figure 1.A). However, the only aquatic listed species that is known to occur in this action area upstream of Woodruff Dam is a single purple bankclimber found in Goat Rock Reservoir in 2000 (Stringfellow 2011 pers. comm.). The proposed action is not anticipated to result in any physical changes to the environment of this individual animal. Therefore, while the action area includes all aquatic habitats that are downstream of the Corps' upstream-most ACF project, Lake Lanier/Buford Dam, ending with and including Apalachicola Bay, the effects of the action are limited to the aquatic habitats downstream of Woodruff Dam ending with and including Apalachicola Bay. This portion of the action area, which we address in the remainder of this BO, is shown in Figure 1.1.A. Hereafter, our use of the term "action area" refers to this limited portion of the broader action area. We refer to locations in the action area by river mile (RM), which is the distance from the mouth of the river as noted on USGS 7.5-minute topographic maps.

## 1.2 Minimum Discharge

Like the 2008 RIOP, the proposed action varies minimum discharges from Jim Woodruff Dam by basin inflow, composite conservation storage level and by month. The releases are measured as a daily average flow in cfs at the Chattahoochee gage. Table 1.2.A illustrates minimum releases from Jim Woodruff Dam prescribed by the proposed action and shows when and how much basin inflow is available for increasing reservoir storage. Except when basin inflow is less than 5,000 cfs and during some down-ramping periods, the minimum releases are not required to exceed basin inflow. The RIOP defines basin inflow threshold levels that vary by three seasons: spawning season (March-May); non-spawning season (June-November); and winter (December-February).

The RIOP incorporates composite conservation storage thresholds that factor into minimum release decisions. Composite conservation storage is calculated by combining the conservation storage of Lake Sidney Lanier, West Point Lake, and Walter F. George Lake. Storage in each of the individual storage reservoirs is divided into four operational Zones. The composite conservation storage utilizes the four-Zone concept as well; e.g., Zone 1 of the composite conservation storage represents the combined conservation storage available in Zone 1 for each of the three storage reservoirs (Figure 1.2.A).

During the spawning season (March-May), the RIOP defines two sets of four basin inflow thresholds and corresponding releases based on composite conservation storage. When composite conservation storage is in Zones 1 and 2, a less conservative operation is in effect. When composite conservation storage is in Zone 3, a more conservative operation allows for greater reten-

tion of basin inflow in storage, and when composite conservation storage falls below the bottom of Zone 3 into Zone 4 the most conservative drought contingency operations are "triggered." Drought contingency operations are described in section 1.4 below. During the spawning season, a daily monitoring plan that tracks composite storage will be implemented in order to determine water management operations. Recent climatic and hydrological conditions experienced and meteorological forecasts will be used in addition to the composite conservation storage values when determining the appropriate basin inflow thresholds to utilize in the upcoming days.

During the non-spawning season (June-November), the RIOP defines one set of four basin inflow thresholds and corresponding releases based on composite conservation storage in Zones 1-3. The proposed action modifies the 2008 RIOP while operating in these composite conservation zones by requiring that releases match or exceed basin inflow when basin inflow is between 5,000 and 10,000 cfs (was between 5,000 and 8,000 cfs in the 2008 RIOP). This change also requires slight adjustments to the basin inflow levels and minimum release provisions at basin inflows greater than 10,000 cfs. Table 1.2.A reflects the proposed action with the modifications to the 2008 RIOP. When composite conservation storage falls below the bottom of Zone 3 into Zone 4 the drought contingency operations are "triggered".

During the winter season (December-February), there is only one basin inflow threshold and corresponding minimum release (5,000 cfs) while in composite conservation storage Zones 1-3. There are no basin inflow storage restrictions provided this minimum flow is met. When composite conservation storage falls below the

bottom of Zone 3 into Zone 4 the drought contingency operations are "triggered".

The flow rates included in Table 1.2.A prescribe minimum, and not target, releases for Jim Woodruff Dam. During a given month and basin inflow rate, releases greater than the Table 1 minimum releases may occur consistent with the maximum fall rate schedule, described below, or as needed to achieve other project purposes, such as hydropower or flood control.

### 1.3 Maximum Fall Rate

The RIOP prescribes maximum fall rates for the releases from Woodruff Dam (Table 1.3.A). Fall rate, also called down-ramping rate, is the vertical drop in river stage (water surface elevation) that occurs over a given period. The fall rates are expressed in units of feet per day (ft/day), and are measured at the Chattahoochee gage as the difference between the daily average river stage of consecutive calendar days. Rise rates (i.e., today's average river stage is higher than yesterday's) are not addressed. The proposed action modifies the maximum fall rate schedule (Table 1.3.A) prescribed by the 2008 RIOP by limiting the maximum fall rate to 0.25 ft/day or less when releases are within powerhouse capacity and less than 10,000 cfs (was 8,000 cfs in the 2008 RIOP). Unless otherwise noted, fall rates under the drought contingency operation would be managed to match the fall rate of the 1-day basin inflow. The Corps proposes to adopt in this amended RIOP its response to RPM 2008-4 of the 2008 BO, which ensures that river stage declines of 8 feet or more will not occur in less than 14 days when river flows are less than 40,000 cfs (March-May). The proposed action eliminates the use of volumetric balancing, which was included in the 2008 RIOP.

## 1.4 Drought Contingency Operations

The RIOP incorporates a drought contingency operation (referred to as drought plan). The drought plan specifies a minimum release from Jim Woodruff Dam and temporarily suspends the other minimum release and maximum fall rate provisions until composite conservation storage within the basin is replenished to a level that can support them. The minimum discharge is determined in relation to composite conservation storage and not average basin inflow under the drought plan. The drought plan is "triggered" when composite conservation storage falls below the bottom of Zone 3 into Zone 4. At that time all the composite conservation storage Zone 1-3 provisions (seasonal storage limitations, maximum fall rate schedule, and minimum flow thresholds) are suspended and management decisions are based on the provisions of the drought plan. The drought plan includes a temporary waiver from the existing WCP to allow temporary storage above the winter pool rule curve at the Walter F. George and West Point projects if the opportunity presents itself and/or begin spring refill operations at an earlier date in order to provide additional conservation storage for future needs, including support of minimum releases from Jim Woodruff Dam.

The drought plan prescribes two minimum releases based on composite conservation storage in Zone 4 and an additional zone referred to as the Drought Zone (Figure 1.2.A). The Drought Zone delineates a volume of water roughly equivalent to the inactive storage in lakes Lanier, West Point and Walter F. George plus Zone 4 storage in Lake Lanier. However, the Drought Zone line has been adjusted to include a smaller volume of water at the beginning and end of the calendar year. When the composite conservation storage is within

Zone 4 and above the Drought Zone, the minimum release from Jim Woodruff Dam is 5,000 cfs, and the Corps may store all available basin inflow above 5,000 cfs. Once the composite conservation storage falls below the Drought Zone, the minimum release from Jim Woodruff Dam is 4,500 cfs, and the Corps may store all available basin inflow above 4,500 cfs. When transitioning from a minimum release of 5,000 cfs to 4,500 cfs, maximum fall rates are limited to a maximum 0.25 ft/day drop. The 4,500 cfs minimum release is maintained until composite conservation storage returns to a level above the top of the Drought Zone, at which time the 5,000 cfs minimum release is re-instated.

Under the 2008 RIOP, the drought plan was in effect until composite conservation storage reached a level above the top of Zone 3 (i.e., within Zone 2). At that time, the temporary drought plan provisions were suspended, and all the other provisions were re-instated. The proposed action modifies the 2008 RIOP drought plan by increasing the composite conservation storage level "trigger" for re-instating normal operations (i.e., the Corps can store more water for a longer period than in the 2008 RIOP). Under the proposed action, the drought plan provisions remain in place until composite conservation storage reaches a level above the top of Zone 2 (i.e., within Zone 1). The proposed action also requires adherence to the spawning season fall-rate provision during drought contingency operations, which ensures fall rates less than 8 feet in 14 days when river flows are less than 40,000 cfs (March-May).

During drought contingency operations, the Corps will assess the status of water management operations relative to the triggers on the first day of each month, also considering other relevant data, recent climatic and hydrological conditions experienced, and meteorological

forecasts will be used when determining the set of operations that apply to the upcoming month.

### 1.5 Conservation Measures

Conservation measures are actions that benefit or promote the recovery of a listed species that a Federal agency includes as an integral part of its proposed action and that are intended to minimize or compensate for potential adverse effects of the action on the listed species. The RIOP and the proposed modifications were formulated in large part to avoid and minimize impacts to listed species while achieving other authorized project purposes. Minimum flow and maximum fall rates are set based upon the current basin inflow in a way that limits most project-induced alterations of the flow regime to higher flow rates. At lower flow rates in the months of March through November and when composite storage is in Zone 3 or higher, the Corps releases a minimum of not less than basin inflow (Table 1.2.A) and limits the rate of river stage decline (Table 1.3.A). When basin inflow is less than 5,000 cfs, which did not occur in the pre-Lanier average daily flow record of the Chattahoochee gage (1929 through 1955), the Corps augments basin inflow, which offsets to some degree the impact of the evaporative losses, non-project related consumptive water uses, and drought conditions more severe than previously observed in the Basin.

* * *

## 1.6 Tables and Figures for Section 1

**Table 1.2.A.** Proposed Action RIOP Releases From Jim Woodruff Dam.

| Months | Composite Storage Zone | Basin Inflow (BI) (cfs) | Releases from JWLD (cfs) | Basin Inflow Available for Storage[1] |
|---|---|---|---|---|
| March - May | Zones 1 and 2 | >= 34,000 | >= 25,000 | Up to 100% BI > 25,000 |
| | | >= 16,000 and < 34,000 | >= 16,000 + 50% BI > 16,000 | Up to 50% BI > 16,000 |
| | | >= 5,000 and < 16,000 | >= BI | |
| | | < 5,000 | >= 5,000 | |
| | Zone 3 | >= 39,000 | >= 25,000 | Up to 100% BI > 25,000 |
| | | >= 11,000 and < 39,000 | >= 11,000 + 50% BI > 11,000 | Up to 50% BI > 11,000 |
| | | >= 5,000 and < 11,000 | >= BI | |
| | | < 5,000 | >= 5,000 | |
| June - November | Zones 1,2, and 3 | >= 22,000 | >= 16,000 | Up to 100% BI > 16,000 |

[1] Consistent with safety requirements, flood control purposes, and equipment capabilities.

| | | | | |
|---|---|---|---|---|
| | | >= 10,000 and < 22,000 | >= 10,000 + 50% BI > 10,000 | Up to 50% BI > 10,000 |
| | | >= 5,000 and < 10,000 | >= BI | |
| | | < 5,000 | >= 5,000 | |
| December -February | Zones 1,2, and 3 | >= 5,000 | >= 5,000 | Up to 100% BI > 5,000 |
| | | < 5,000 | >= 5,000 | |
| At all times | Zone 4 | NA | >= 5,000 | Up to 100% BI > 5,000 |
| At all times | Drought Zone | NA | >= 4,500[2] | Up to 100% BI > 4,500 |

[2] Once composite storage falls below the top of the Drought Zone ramp down to 4,500 cfs will occur at a rate no greater than 0.25 ft/day drop.

* * *

### 4.2.2 General Effects on the Flow Regime

The Corps alters the flow regime of the Apalachicola River by storing and releasing water from its reservoirs. The ResSim model of the RIOP simulates these operations using the historically measured/estimated consumptive water uses. To the extent that these consumptive use data are accurate, differences between the historically observed flows (i.e., baseline, 1975 to 2008) and the simulated flows of the RIOP are due to differences in reservoir operations, as the model is driven by the observed hydrology. The volume of water in the Corps' three largest ACF reservoirs (composite storage of Lanier, West Point, and W.F. George) is seldom stable for extended periods, and follows a general pattern of increasing storage from January through June or July, and decreasing storage thereafter. The expected general pattern of flow alteration, therefore, is depletion during the first half of the year during periods of relatively high flow and augmentation during the second half of the year during periods of relatively low flow.

Figure 4.2.2.A shows the magnitude of this annual cycle of re-fill and draw-down by comparing the January-to-June maximum composite storage level with the July-to-December minimum composite storage level for both historical operations and the RIOP for the years 1976 to 2008 (we could not use 1975 to 2008 for this comparison because composite storage values for the complete year of 1975 were not available). The primary difference between the observed historical levels and the RIOP levels is the amplitude of the annual cycle: the RIOP generally has lower maximum storage in the first half of the year, and higher minimum storage in the

second half of the year. The annual average drawdown under the RIOP by this measure is 407,003 acre feet, compared to 653,772 acre feet historically, a 38% reduction in reservoir drawdown. Stored or released at a constant rate over a 6-month period (180 days), these volumes are equivalent to flow rates of 1,140 cfs and 1,831 cfs, respectively.

Figures 4.2.2.B and 4.2.2.C examine how the RIOP's change in the overall range of reservoir elevations would affect the seasonal timing and magnitude frequency of the flow of the Apalachicola River. These figures show the frequency (% of days) that daily average discharge (cfs) values are exceeded during the years 1975-2008 for each calendar month. To better view the differences between the exceedance frequencies of the historical flows and the RIOP flows, Figures 4.2.2.B and 4.2.2.C display the results of this analysis for flows that are exceeded more than 10% of the time because the highest flows are generally several orders of magnitude greater than all other flows and would require a much expanded scale for the vertical axis. Figures 4.2.2.B and 4.2.2.C also list the average of all the days included in the analysis for each month, including the highest flows, which is a measure of the total volume of water represented by the frequency/magnitude curves.

Despite the reduced amplitude of the annual reservoir refill/drawdown cycle noted above, the frequency and magnitude of simulated flows under the RIOP are generally comparable to historical flows in January through April and in December. Average flows under the RIOP for these months are within 3% of the historical baseline averages. The remaining months of the year, however, show greater departures from the historical flows. RIOP flows are higher more often in No-

vember, making average flow in November 10.7% greater under the RIOP. Average flow in October is 4.0% greater under the RIOP, with higher frequencies at flows greater than about 14,000 cfs and less than about 10,000 cfs. RIOP flows are generally lower more often in May through September, with the greatest departures in August and September, where average flows of the RIOP are 1,053 cfs (7.4%) and 757 cfs (6.3%) lower than historical baseline flows, respectively. Lower flows during these months negatively affect mussels because the risk of exposure is higher, habitat is constricted, and water temperatures are higher.

We used the Corps' simulated RoR operation to count the number of days that reservoir operations, both historically observed and simulated under the RIOP, were either decreasing or increasing the flow into the Apalachicola River, and to quantify the volume of that depletion and augmentation. For simplicity, we counted all deviations from RoR flow as either a depletion or an augmentation, and on no days did the simulated RoR flow exactly equal the Baseline or RIOP flow. Historical ACF reservoir operations altered the flow 56.3% of the days by flow augmentation and 43.7% of the days by flow depletion, whereas the RIOP simulation is slightly more evenly divided between augmentation days (53.7%) and depletion days (46.3%). The more striking difference between the Baseline and the RIOP is in the volume of the alterations. When Baseline flow was greater than the estimated RoR flow, the average daily augmentation was 3,287 cfs, and when Baseline flow was less than RoR, the average daily depletion was 3,936 cfs. Under the RIOP, average daily augmentation was 1,801 cfs, and average daily depletion was 2,066 cfs. Operations in support of commercial navigation throughout most of the Baseline, a practice which

is not simulated in the RIOP, may partially account for this difference in depletion/augmentation volumes. However, even in the more recent years of the Baseline (post 1999), during which the Corps has only occasionally stored water and made releases for navigation, the average daily flow alteration (both augmentation and depletion) is about 50 percent greater than under the same years of the RIOP simulation.

The RIOP model maintains a minimum release from Woodruff Dam of between 4,550 and 5,050 cfs, a flow range which occurs about 3.7% of the time (464 days) in the years 1975-2008. Flows less than or equal to 5,050 cfs occurred for 117 days in the Baseline record, or 0.9% of the time, and the lowest flow recorded was 3,900 cfs. The RIOP is intended to support the minimum flow 5,000 cfs until composite storage falls into the "drought zone" of Zone 4, which occurs for one month in the simulation (November, 2007). Only the 5,000 cfs minimum release (and 4,500 cfs while in the drought zone) and downramping according to the fall rate schedule are supported with releases from storage: all other minimum release provisions of the RIOP do not require flows that are greater than current levels of basin inflow. If we discount the storage required to meet the fall rate schedule, we may estimate the amount of storage required each year solely to sustain the minimum release schedule of the RIOP as the sum of daily deficits in basin inflow relative to 5,050 cfs (5,050 minus basin inflow), and relative to 4,550 cfs during drought operations (4,550 minus basin inflow in November, 2007). Figure 4.2.2.D shows the total deficits for the years 1975 to 2008 using the RoR simulation as the measure of basin inflow (actual operations use 7-day average basin inflow computed from daily local inflow for each reservoir). Most years (19 years of the 34 years, or

55.9%) have no deficit, and the non-zero deficit years vary from almost none to 702,411 ac-ft in 2007. Total storage capacity of lakes Lanier, West Point, and George is about 3.5 million ac-ft, of which 1.6 million ac-ft is considered "conservation" or "active" storage.

We examine the possible effects of these various changes to the flow regime to the listed species and their habitats in the remaining sections of this chapter.

* * *

## 6 CONCLUSION

The proposed action provides both beneficial and adverse effects to the species and designated critical habitats we have assessed. To the extent that the consumptive use assumptions are accurate, differences between the Baseline and the simulated flows of the RIOP are due to differences in reservoir operations, as the model is driven by the observed hydrology. Therefore, we attribute all differences between the Baseline and RIOP simulated flow regime to the Corps' discretionary operations. Differences between the Baseline and RIOP are summarized in general form below (for more details, see sections 4 and 5):

Beneficial Effects

- Basin inflow is augmented when it is less than 5,000 cfs; no daily flows would be less than 5,000 cfs at the Chattahoochee gage. However, if exceptional drought provisions are triggered, this would become no days less than 4,500 cfs (Figure 4.2.3.A).
- The frequency (percent of years) of growing-season (April-October) floodplain connectivity to the main channel is increased (Figure 4.2.4.B).

- A reduction in the inter-annual frequency of flows less than 7,500 cfs (Figure 4.2.3.A).
- A decrease in the maximum number of days/year of flows at all levels except less than 6,000 cfs (Figure 4.2.3.B).
- A decrease in the maximum number of consecutive days/year of flows between 7,000-10,000 cfs (Figure 4.2.3.C).
- A decrease in the median number of days/year of flows less than 9,000 cfs (Figure 4.2.3.D).
- A decrease in the median consecutive number of days/year of flows less than 8,000 cfs (Figure 4.2.3.E).
- Lower fall rates in the most extreme categories (>1 ft/day) (Figures 4.2.3.F-H).

Adverse Effects

- RIOP flows are lower than the baseline more often in May through September, with the greatest departures in August and September (Figures 4.2.2.B-C).
- Lower minimum flows in about half the years from 1975-2008 (Table 4.2.3.A)
- An increase in inter-annual frequency of flows from about 7,500 to 10,000 cfs (Figure 4.2.3.A).
- An increase in maximum number of days per year of flows less than 6,000 cfs (Figure 4.2.3.B).
- An increase in maximum number of consecutive days per year of flows less than 6,000 cfs (Figure 4.2.3.C).

- An increase in median number of days per year of flows between 7,000 and 9,500 cfs (Figure 4.2.3.D).
- An increase in the median consecutive number of days/year of flows less than 9,000-10,000 cfs (Figure 4.2.3.E).
- An increase in percent of days with fall rates from 0.25 to 1.0 ft/day (Figure 4.2.3.F).
- An increase in the median fall rates over the Baseline rate in the range of flows where mussels occur (Table 4.2.3.B).
- Fall rates less than about 0.20 ft/day occur with greater frequency than the Baseline period (when flows are less than 8,000 cfs) since the implementation of the maximum fall rate schedule in 2006 (Figure 4.2.3.H).

Most of these effects, both the beneficial and the adverse, derive from relatively minor differences between the RIOP and Baseline. Generally, it appears that the Corps would store water more often and augment flows less often under the RIOP than has occurred historically. The RIOP uses some of this stored water to maintain a minimum flow of 5,000 cfs, but the frequency of flows less than 10,000 cfs is increased.

The remainder of this section summarizes and consolidates our findings in the previous sections for each listed species and critical habitat in the action area.

### 6.1 Fat threeridge

Fat threeridge located in moderately depositional habitat are likely moving in response to changing water levels to maintain an optimal depth or associated habitat parameter. Sediment deposition also likely plays a role. At the time of the 2008 BO there were no listed mussels

at river stages greater than 5,000 cfs due to the drought of 2006-2008. Although we noted that take may occur when individuals occupy stages greater than 5,000 cfs, we did not anticipate take under this scenario because it was considered an anomaly related to very high flows in 2005. However, based on recent data, it appears that fat threeridge readily recolonize higher bank elevations at flows greater than 5,000 cfs, where they could be at risk of stranding and mortality when flows decline.

Mortality during these events was highest in the Wewa reach of the Apalachicola River where the main channel populations are the most abundant and slopes are shallow. Some mortality occurred in the Chipola River, but it appears to be limited. Mortality estimates from these all of these events range from <1% to 2% depending on preceding hydrologic conditions, fall rates, habitat condition, and the size of the population in Swift Slough. Since the first event was recognized in 2006, 3-4% of the total estimated population of fat threeridge may have died during these various low flow events. We may be over-estimating the relative amount of mortality because we are likely underestimating the total population of fat threeridge in the action area.

Channel morphology changes have likely contributed to a substantial decline of the species distribution in the upstream-most 30 miles of the river. It is abundant in moderately depositional habitat in the Wewa reach and the Chipola River and the population is relatively large. There is evidence of good recruitment in the Wewa and Lower reaches, but more information is needed to determine the status of recruitment in the Chipola River.

Based on best available information, we believe the population of fat threeridge in the action area is stable and possibly increasing. The population appears to be

doing well despite the principal effects to the fat threeridge in the action area that we described in section 3, Environmental Baseline. The inter-annual frequency and the intra-annual duration of low flows in the pre-Lanier period substantially increased in the post-West Point period. Flows under the RIOP will further increase the frequency and duration of low flows. Flows less than 5,000 cfs were not recorded in the pre-Lanier period. The RIOP supports a minimum flow of 5,000 cfs, which benefits the fat threeridge, except when exceptional drought operations are triggered and minimum-flow support is reduced to 4,500 cfs. Supporting a minimum flow of 5,000 cfs in the future with less basin inflow as demands increase would require greater storage releases from the reservoirs, which could trigger the 4,500 cfs minimum flow provision of the RIOP more frequently. The results of the PVA indicate that the population can sustain reductions of 1-2% that we estimate occurred in the population recently if such reductions occur with a probability of once every 6 years, and if similar reductions occur when flows are reduced to 4,500 cfs, with a probability of once every 69 years. However, the PVA also indicates that increasing the frequency of such events results in a greater impact to long-term population viability. As such, we need to continue to monitor the frequency and severity of these events. If the events occur with greater frequency, it may be necessary to reinitiate consultation.

Therefore, our analysis indicates that the RIOP would have a negative, but not appreciable, impact on the survival and recovery of the fat threeridge due to mortality and other adverse effects if flows are reduced to 4,500 cfs or if additional recolonization and subsequent mortality occurs at flows above 5,000 cfs.

### 6.2 Purple bankclimber

Although the population of purple bankclimbers at the Race Shoals (the limestone shoal at RM 105) is relatively large (about 30,000 individuals), the species is apparently rare in the rest of the river and may be experiencing poor recruitment. A whole river population estimate is not available, but the species is much more detectable and probably much more abundant in other parts of its range, such as the Flint River and the Ochlockonee River. The principal effects to the purple bankclimber in the action area are those we described in section 3, Environmental Baseline. Channel morphology changes may have contributed to a decline of the species in the upstream-most 30 miles of the river, although the species is still found in this reach in relatively high numbers at Race Shoals. Flow regime alterations discussed above (section 6.1) for the fat threeridge apply also to the bankclimber, but probably to a lesser extent, because this species appears to occur more often in deeper portions of the stream channel than the threeridge. As such, we have observed limited mortality of the population during low flows since 2008.

Therefore, our analysis indicates that the RIOP would have a negative, but not appreciable, impact on the survival and recovery of the purple bankclimber due to mortality and other adverse effects if flows are reduced to 4,500 cfs or if additional recolonization and subsequent mortality occurs at flows above 5,000 cfs. Bankclimbers are rarely found at stages greater than 4,500 cfs in the Apalachicola River.

### 6.3 Chipola slabshell

Recent surveys (1990 to present) have documented many new subpopulations but found the species gener-

ally occurs in relatively low abundance. We have no evidence that these populations are currently declining and we consider the Chipola slabshell status to be stable. Many of the effects we described in section 3, Environmental Baseline, do not apply to the Chipola slabshell, as its known range within the action area is limited to the Chipola River downstream of the Chipola Cutoff. Most of the species range is in the Chipola River upstream of the action area. Channel morphology appears less altered in the Chipola River than the Apalachicola River. Flow regime alterations discussed above (section 6.1) for the fat threeridge apply also to the slabshell, but probably to a lesser extent in the narrower channel and higher bank slopes of the Chipola. No slabshell mortality has been documented during the low flows of 2006-2008 and 2010-2011. We also expect the mortality of the Chipola slabshell to be less than the expected for the fat threeridge or purple bankclimber because of its expected higher mobility.

Therefore, our analysis indicates that the RIOP would have a negative, but not appreciable, impact on the survival and recovery of the Chipola slabshell due mortality and other adverse effects if flows are reduced to 4,500 cfs or if additional recolonization and subsequent mortality occurs at flows above 5,000 cfs.

### 6.4 Critical Habitat

Designated critical habitat for the fat threeridge and purple bankclimber in the action area includes most of the Apalachicola River unit, and the downstream-most part of the Chipola River Unit. Designated habitat for the Chipola slabshell only occurs within the downstream-most part of the Chipola River Unit. In the effects analysis, we discussed how the RIOP may affect the three of the five PCEs of the mussel critical habitat:

1) permanently flowing water; 2) water quality; and 3) fish hosts. The RIOP does not appear to reduce the amount of floodplain habitat available to fish hosts, some of which likely rely upon floodplain habitats for spawning and rearing habitat. Droughts substantially change the nature of all of these PCEs compared to normal flows, but our analysis does not show that the RIOP would appreciably change the quantity or quality of the PCEs relative to the Baseline under the drought conditions represented in the 1975-2008 record.

While the RIOP may also negatively affect mussel habitat primary constituent elements by reducing minimum releases to 4,500 cfs, the circumstances triggering this action would occur infrequently (probability of 1 in 69 years). We do not anticipate that increasing the frequency and duration of low flows or reducing minimum releases to 4,500 cfs at this frequency would alter or affect the critical habitat in the action area to the extent that it would appreciably diminish the habitat's capability to provide the intended conservation role for the three mussel species. In addition, the nature of these effects is dynamic and would not produce permanent or static alterations to any PCE.

### 6.5 Determinations

After reviewing the current status of the listed species and designated critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed action: 1) will not jeopardize the continued existence of the fat threeridge, purple bankclimber, and Chipola slabshell; and 2) will not destroy or adversely modify designated critical habitat for the fat threeridge, purple bankclimber, and Chipola slabshell.

The RIOP is intended to apply until a new WCP is adopted. Given the Corps' current timeline, the findings of this BO shall apply for 5 years until May 22, 2017, or until amended through a reinitiation of consultation or superseded with a new opinion for a new proposed action.

* * *

# APPENDICES AND EXHIBIT A TO THE AFFIDAVIT OF JUDSON H. TURNER, DIRECTOR OF THE GEORGIA ENVIRONMENTAL PROTECTION DIVISION (January 10, 2013)

## APPENDIX 1

### Historical and Forecasted Population of Counties Using Lake Lanier System for Water Supply

| County | 1990[1] | 2000[1] | 2010[1] | 2020[2] | 2030[2] | 2040[3] |
|---|---|---|---|---|---|---|
| Cobb | 447,745 | 607,751 | 688,078 | 800,469 | 909,747 | 1,033,943 |
| Dawson[4] | 9,429 | 15,999 | 22,330 | 27,029 | 32,022 | 37,937 |
| DeKalb | 545,837 | 665,865 | 691,893 | 761,537 | 817,276 | 877,096 |
| Forsyth | 44,083 | 98,407 | 175,511 | 256,307 | 383,258 | 573,089 |
| Fulton | 648,951 | 816,006 | 920,581 | 1,095,897 | 1,284,954 | 1,506,626 |
| Gwinnett | 352,910 | 588,448 | 805,321 | 1,019,098 | 1,270,020 | 1,582,724 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Habersham[4] | 27,621 | 35,902 | 44,553 | 48,705 | 54,623 | 61,260 |
| Hall | 95,428 | 139,277 | 179,684 | 226,172 | 282,164 | 352,018 |
| Lumpkin[4] | 14,573 | 21,016 | 29,966 | 38,075 | 47,960 | 60,411 |
| White[4] | 13,006 | 19,944 | 26,704 | 31,057 | 34,841 | 39,086 |
| Totals[5] | 2,199,583 | 3,008,615 | 3,584,621 | 4,273,267 | 5,116,865 | 6,127,000 |

[1] From US Census Bureau

[2] Georgia Office of Planning and Budget 2012 Projections

[3] Projection based upon assumption that 2030–2040 growth rate (in per cent) will be same as 2020–2030.

[4] Watershed counties not currently withdrawing from Lanier, but may withdraw in future.

[5] This total does not include the additional counties that purchase water from the water systems that withdraw water from Lake Lanier and the Chattahoochee River, such as Paulding County.

## APPENDIX 2

### Water Systems That Withdraw Directly from Lake Lanier

| County | System Name | 2011 Withdrawals (MGD) | | |
|---|---|---|---|---|
| | | Max. Month | Max. Day | Annual Average |
| Forsyth | City of Cumming | 17.5 | 18.8 | 11.6 |
| Forsyth | Forsyth County | 11.8 | 12.8 | 8.6 |
| Gwinnett | City of Buford | 1.5 | 1.7 | 1.3 |
| Gwinnett | Gwinnett County Water & Sewerage Authority | 90.9 | 118.8 | 76.1 |
| Hall | City of Gainesville | 20.7 | 28.5 | 17.6 |
| Total | | | | 115.2 |

## APPENDIX 3

**Water Systems That Rely on Water Supply Releases from Lake Lanier to the Chattahoochee River**

| County | System Name | 2011 Withdrawals (MGD) | | |
|---|---|---|---|---|
| | | Max. Month | Max. Day | Annual Average |
| Cobb | Cobb County Marietta Water Authority | 51.9 | 64.8 | 45.1 |
| DeKalb | DeKalb County Public Works (Water and Sewer) | 84.7 | 114.8 | 72.7 |
| Fulton | Atlanta-Fulton Water Resources Commission | 54.3 | 69.9 | 38.7 |
| Fulton | City of Atlanta | 101.8 | 123.4 | 89.2 |
| Total | | | | 245.7 |

## APPENDIX 4

## Projected 2040 Water Withdrawals and Returns

(Annual Average)

Table 1 Current and Projected 2040 Water Withdrawals and Returns Above Buford Dam

| Time Horizon | Withdrawal (mgd) | Return (mgd) | Net Consumptive Loss (mgd) |
|---|---|---|---|
| 2011 | 120.6[1] | 38.1 | 82.4 |
| 2040 | 297 | 165 | 132 |

Table 2 Current and Projected 2040 Chattahoochee River Water Withdrawals and Returns

| Time Horizon | Withdrawal (mgd) (Buford Dam to Peachtree Creek) | Return (mgd) | | | Net Consumptive Loss (mgd) |
|---|---|---|---|---|---|
| | | Atlanta Reach (Buford Dam to Peachtree Creek) | Whitesburg Reach (Peachtree Creek to Whitesburg gage) | Total | |
| 2011 | 247.5[2] | 34.5 | 185.3 | 219.8 | 27.7 |
| 2040 | 408 | 94 | 291 | 385 | 23 |

Notes:

[1] Including facilities upstream of Lake Lanier. These additional withdrawals are included to provide the sum of all consumptive loss above Buford Dam.

[2] Including facilities that withdraw from tributaries of the Chattahoochee River. These additional withdrawals are included to provide the sum of all consumptive loss below Buford Dam and above the Whitesburg gage.

## APPENDIX 5

## HTIME REQUIRED TO PLAN, PERMIT, FINANCE, AND CONSTRUCT WATER SUPPLY RESERVOIRS IN GEORGIA

| Project / Activity | Bear Creek Reservoir, Jackson Co. | Cedar Creek Reservoir, Hall Co. | Tussahaw Creek Reservoir, Butts Co. | Big Haynes Creek Reservoir, Rockdale Co. | Line Creek Reservoir (Lake McIntosh), Fayette Co. | Hickory Log Creek Reservoir, Cherokee Co. |
|---|---|---|---|---|---|---|
| Applicant's initial contact with EPD regarding a new reservoir. | 2/2/1994 | 7/17/1996 | 9/22/2000 | 11/5/1987 | 10/27/1987 | 3/22/2000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Applicant initial contact with the Corps regarding 404 permit for reservoir | 2/2/1994 | 7/17/1996 | 9/22/2000 | 4/29/1991 | 1/6/1989 | 3/22/2000 |
| Applicant submits water withdrawal permit application | 3/3/1997 | 4/2/2002 | 3/13/2001 | 6/21/1999 | 3/21/2001 | 10/4/2005 |
| EPD comments on withdrawal application | 5/28/1997 | 4/22/2002 | 5/22/2001 | 12/7/1999 | 4/16/2001 | 11/22/2005 |
| EPD provides confirmation of need (to the Corps). | 4/20/1995 | Information unavailable | 11/3/2000 | 5/6/1991 | 11/20/2000 | 11/20/2000 |
| Applicant submits 404 application to the Corps. | 2/22/1995 | 8/26/1997 | 11/15/2000 | 5/28/1991 | 5/1/2002 | 4/27/2000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| The Corps notifies public of the 404 application and requests comments | 5/26/1995 | 10/8/1997 | 12/27/2000 | 11/22/1991 | 10/3/2002 | 12/27/2000 |
| The Corps responds to applicant's 404 application | 7/1/1995 | 11/13/1997 | 2/1/2001 | 12/28/1991 | 11/8/2002 | 2/28/2001 |
| EPD issues 401 Water Quality Cert. | 5/17/1996 | 8/21/1998 | 5/22/2001 | 8/31/1992 | 9/6/2006 | 8/2/2002 |
| EPD issues with-drawal permit | 4/1/2002 | 8/1/2002 | 2/14/2003 | 3/22/2002 | 9/6/2006 | 9/12/2008 |
| The Corps issues final 404 permit to applicant | 7/20/1996 | 11/16/1998 | 10/23/2002 | 10/2/1992 | 6/27/2007 | 5/24/2004 |
| EPD issues Safe Dams permit | 10/1999 | 10/2001 | 8/25/2003 | 5/31/1994 | 12/9/2009 | 4/29/2008 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Jurisdiction constructs dam. | 04/2011 | 9/11/2003 | June 2005 | 1/27/1997 | April 2010 | 8/5/2005 |
| Jurisdiction fills reservoir. | Spring 2002 | 8/11/2005 | Sept. 2005 | June 1998 | Started November 1, 2012 | 6/30/2011 |

**EXHIBIT A**

**Memorandum of Dr. Wei Zeng**
**Manager, Hydrologic Analysis Unit**

[Georgia Department of Natural Resources letterhead]

Memorandum

To: Judson Turner, Director, Georgia EPD
From: Wei Zeng, Hydrology Unit, Georgia EPD
Date: January 10,2013
Subject: Technical Analysis of Georgia's 2000 Water Supply Request

Introduction

You asked me to analyze the impact to the federal reservoirs in the Apalachicola-ChattahoocheeFlint (ACF) River Basin, to hydropower production and recreation at those reservoirs, and to river flows at the state line with Florida, of Georgia's 2000 Water Supply Request. Georgia submitted the water supply request to the U.S. Army Corps of Engineers in May 2000, asking for the Corps to operate Lake Lanier to accommodate future municipal and industrial direct withdrawals from Lake Lanier and river withdrawals downstream totaling 705 million gallons per day (mgd). As more than twelve years have passed since Georgia submitted its water supply request to the Corps, Georgia is providing the Corps updated demographic and water demand information in support of its request. Georgia forecasts that its municipal and industrial water supply demands from

Lake Lanier will reach or exceed 705 mgd by approximately 2040.

The Hydrology Unit of EPD set up a mathematical model of the ACF Basin to analyze the potential impacts of Georgia's request. This memorandum documents the model settings and results.

Platform Model- HEC-ResSim

The mathematical model that we used for this analysis was developed by the U.S. Army Corps of Engineers Hydrologic Engineering Center (HEC) for analyzing reservoir operations and basin-wide water resource management. The Corps calls this platform model "HEC-ResSim." The Corps periodically upgrades HEC-ResSim's capability. The Corps released its current version of the model to the public in May 2011. This version of the model reflected the Corps' then-current ACF Basin reservoir operating plan, known as the Revised Interim Operation Plan (RIOP), as it existed as of May 2011.

Since May 2011, the Corps has made minor changes to the RIOP. The Hydrology Unit of EPD has added these changes to the Corps' May 2011 platform model. Thus, EPD's version of the HEC-ResSim model reflects operations under the current RIOP.

We modeled a 34-year period, assuming rainfall and inflow conditions that occurred from January 1, 1975 to December 31, 2008, and applied to each of these years the Corps' RIOP and, as discussed below, varying levels of water supply use. We chose the 1975-2008 period for several reasons. First, the Unimpaired Flow (UIF) data developed by the Corps only covers hydrologic conditions through December 31, 2008. In addition, this period excludes the period before all ACF federal res-

ervoirs have been in operation. Finally, the U.S. Fish and Wildlife Service has used the same simulation period for its analyses of various ACF operations. It should be noted that the droughts that most affected the federal reservoirs in the ACF Basin occurred within in this period, with the possible exception of the current drought, the duration and severity of which cannot yet be determined.

Model Setting on Water Demand

To understand the impacts of Georgia's water supply request, we compiled current and proposed future water use conditions and ran three different scenarios: what we call Baseline Condition, Scenario A, and Scenario B. The Baseline Condition assumes current water use, as further defined below. Scenario A isolates the effect of the withdrawals associated with Georgia's water supply request by applying to the model annual average gross withdrawals of 705 mgd from Lake Lanier and the Chattahoochee River through Atlanta but keeps current demands throughout the remainder of the ACF Basin. Scenario B evaluates the effects of the water use contemplated in Georgia's water supply request in combination with forecasted demands throughout the basin by assuming annual average gross withdrawals of 705 mgd from Lake Lanier and the Chattahoochee River through Atlanta and year 2040 water use throughout the remainder of the ACF Basin in Georgia, plus increasing water use in ACF Basin in Alabama, as discussed further below.

*Baseline Condition*

To capture the effect of current water use within the ACF Basin, we included in the model the most recent available annual (2011) withdrawal and discharge data of all permitted municipal and industrial facilities in the

Georgia portion of the ACF Basin. These include thermal electric power generating facilities that use water for cooling purposes and that incur consumptive water losses as a result of their cooling operations. We included the estimate of 2007 total ACF Basin agricultural water use that Georgia developed as part of its statewide water planning, which is the best information that we have on Georgia's current agricultural use.

We included Alabama's 2007 water consumption from the ACF Basin as estimated by the Alabama Office of Water Resources (OWR) in 2009. For water consumption in Florida, we used the numbers contained in the Corps' platform model.

In the Baseline Condition, and in Scenarios A and B, we assumed the current RIOP would remain in effect.

*Scenario A – Impact of Water Supply Request*

As Georgia's water supply request remains 297 mgd annual average gross lake withdrawal and 408 mgd annual average gross river withdrawal, for a total of 705 mgd, those are the amounts of withdrawal that we used in the impact analysis. We added back projected returns of treated wastewater to Lake Lanier and the Chattahoochee River. Using EPD projections, we assumed that 78% of the 705 mgd that is withdrawn will be discharged back to surface waters within the basin in the form of highly treated wastewater. This includes 165 mgd returned to Lanier and its upstream tributaries, 94 mgd returned to the Chattahoochee River between Buford Dam and Peachtree Creek, and 291 mgd returned to the Chattahoochee River downstream of Peachtree Creek. As Scenario A is intended to isolate the impact of meeting the forecasted water supply needs that would be dependent on withdrawals and water supply releases from Lake Lanier, we held water

use elsewhere in the basin at current levels (that is, levels according to most recent data available).

*Scenario B – Impact of Water Supply Request in Combination with Other 2040 Georgia Demands in ACF Basin*

In Scenario B, we added to the water supply uses contemplated by Georgia's water supply request the other projected 2040 water demands within the ACF Basin in Georgia. These include projected municipal, industrial, and agricultural water needs. EPD developed the forecasts for those demands as part ofthe planning associated with the State Water Plan and Regional Water Development Plans. We do not have projected water demands for portions of the basin that are in Alabama. To estimate the cumulative impact resulting from future Alabama demand, we assumed an increase of 15% to the current Alabama figure used in the baseline condition alternative. We held the level of water use in the Apalachicola River reach the same as in the Baseline Condition because we have no information upon which to base an estimate of future water use in the State of Florida. I have enclosed a DVD containing these models.

Results and Analysis

In my discussion of the modeling results, Scenarios A and B are compared to the Baseline Condition. The potential impact of Georgia's Request is described with regard to:

(1) Average elevations in the federal reservoirs of Lanier, West Point, and Walter F. George;

(2) Minimum elevations in these reservoirs;

(3) Elevation duration curves in these reservoirs;

(4) Daily average power generation in the federal reservoirs;

(5) Percentage of time when there is some level of recreational impact; and

(6) State line flow duration curve.

*Reservoir Elevations*

Using the Res-Sim Model, we determined the average and minimum daily elevations, and the elevation duration curves, of the federal reservoirs in the ACF Basin under the Baseline Condition and Scenarios A and B. The average and minimum daily elevations of a reservoir are obtained by looking at the daily elevation of the period of simulation, from January 1, 1975 to December 31, 2008, and calculating the average and minimum daily value for each of the 365 days in a year. The elevation duration curve shows the percentages of time over the entire 34-year period that the reservoirs will exceed certain elevations.

As shown in Slides 9 and 25 of the attached Exhibit 1, the average daily elevation of Lake Lanier under both Scenarios A and B will be no more than 0.7 feet lower around May 1 as compared with the Baseline Condition. May 1 is the date on which the top of conservation pool guide curve for Lake Lanier rises to 1071 feet for the first time in the year and is the beginning of the primary recreational season. Similarly, the average daily elevation of Lake Lanier around December 1 under Scenarios A and B is no more than 1.5 feet lower than under the Baseline Condition.

The difference between the Baseline Condition and Scenarios A and B is more pronounced in terms of the daily minimum elevation in Lake Lanier. (See Slides 10 and 26.) At the lowest point on the minimum daily ele-

vation curve, which usually takes place in the month of December, the elevation under Scenarios A and B is approximately 6 feet lower than in the Baseline Condition.

The elevation duration curves for Lake Lanier are shown on Slides 11 and 27. For the upper 30% of the duration curve (representing the times of higher reservoir elevation), the elevation of Lake Lanier is essentially the same in the Baseline Condition and Scenarios A and B. Moreover, for approximately 70% of the duration curve, the elevation under Scenarios A and B is only approximately one foot or less lower than in the Baseline Condition. The difference is greater, up to 6 feet, at the lowest point in the lower 30% of the duration curve.

The impact on Lakes West Point and Walter F. George is minor. (See Slides 12 through 17 and Slides 28 through 33.) There is very little, only inches, difference in average daily elevation at both West Point and Walter F. George between the Baseline Condition and Scenarios A and B. In terms of minimum daily elevation, the greatest difference between the Baseline Condition and Scenarios A and B is only 1.5 feet in West Point (in the months of September and October), and up to 1.2 feet at Walter F. George (in September and October). At the point in the year when West Point and Walter F. George typically reach their lowest elevation for the year (usually in November or December), there is little difference between the Baseline Condition and Scenarios A and B. Even less of a change is evident in the elevation duration curves for Lakes West Point and Walter F. George. (See Slides 14, 17, 30, and 33).

*Power Generation*

The projected water withdrawals and Corps operations necessary to support them will not have a material impact on the production of hydropower at Buford Dam. Under Scenario A, with water supply needs of 705 mgd for the Metro Atlanta Area and current demands elsewhere, the daily average energy generated at Lake Lanier is modeled to be 319 MWh, and the annual average energy generated at Lake Lanier is modeled to be 116,435 MWh. In comparison, the daily average energy generated under the Baseline Condition is modeled to be 339 MWh and the annual average is 123,735 MWh. When Georgia has reached demands of 705 mgd from Lake Lanier and the Chattahoochee River above the Peachtree Creek confluence, combined with 2040 water supply demands throughout the remainder of the basin, the annual average energy generated at Lake Lanier is modeled to be 116,435 MWh, in comparison to 123,735 MWh under the Baseline Condition. Thus, assuming 2040 water supply demands throughout the ACF Basin, there would be less than a 6% reduction in power produced at Lanier. The impact will be even less in the years before Georgia's water demand has reached 705 mgd.

As shown by Slides 18 and 34, Georgia's future water supply demands will have very little impact on the total amount of energy produced by all of the federal reservoirs in the ACF Basin. Under Scenario A, when Georgia has reached demands of 705 mgd, the daily average energy output from all ACF federal reservoirs is modeled to be 2,671 MWh (annual average 974,915 MWh). The daily average energy output under the Baseline Condition is 2,707 MWh, and the annual average is 988,055 MWh. Thus, there will be only a reduction in daily average generation of 36 MWh (annual av-

erage reduction of 13,140 MWh) for all reservoirs combined. Under Scenario B, the daily average energy output from all ACF federal reservoirs is modeled to be 2,660 MWh (annual average 970,900 MWh). The reduction in daily average generation will be only 47 MWh (annual average reduction of 17,155 MWh). For the combined generation of all of the federal reservoirs in the ACF Basin, there is only a 1.3% reduction under Scenario A and a 1.7% reduction under Scenario B. Georgia's conclusions are consistent with those reached by the Corps in its assessment of the impact to hydropower from granting Georgia's water supply request as compared with a baseline that assumed virtually no water supply operations at all. Using that baseline of comparison, the Corps concluded that the water supply operations and lake withdrawals under Georgia's water supply request each would result in less than a 1% reduction to ACF Basin dependable hydropower capacity; that the lake withdrawals contemplated by the request would result in a reduction in basin-wide hydropower value of 4.4%; and, that the water supply releases contemplated by the request would result in a reduction in basin-wide hydropower value of less than 1%.

*Recreational Impact*

We evaluated the recreational impact by looking at the primary recreational season, defined by the Corps as May 1st through September 8th, and tallying the percentage of days when elevation of a reservoir is lower than the three levels of recreational impact, which are, in increasing degree of impact, the Initial Impact Line (IIL), Recreational Impact Line (RIL), and Water Access Limitation (WAL). According to the Corps, the IIL at Lake Lanier is 1066 feet above mean sea level (msl), the RIL is 1063 feet above msl, and the WAL is 1060 feet above msl. For West Point Lake, the ILL is

632 feet above msl, RAL is 628 feet above msl, and WAL is 627 feet above msl. For Lake Walter F. George, the ILL is 187 feet above msl, the RAL is 185 feet above msl, and the WAL is 184 feet above msl.

The impact to recreation is shown on Slides 19 through 21 and 35 through 37. In Scenarios A and B as compared with the Baseline Condition, the increase in percentage of days of IIL, RIL, and WAL at Lake Lanier will be 5%, 8%, and 8% respectively. Under hydrologic conditions of Year 2007, a drought year of exceptional dry conditions, the total number of days when the elevation of Lanier falls below the RIL under Scenario A is 47 days, under Scenario B is 48 days, and under the Baseline Condition is 27 days.

The recreational impact on West Point and Walter F. George is virtually non-existent. The only impact on West Point under Scenario A and Scenario B is a 1% increase in the frequency of WAL, while the recreational impact of IIL and RIL actually are lessened. At Walter F. George, there is a 1% and 2% increase in IIL in Scenario A and Scenario B, respectively. The elevation of Walter F. George does not fall to the RIL or WAL in any of the three scenarios.

*State Line Flow*

There is no noticeable difference between Scenario A and the Baseline Condition alternative in terms of state line flow duration curve, which suggests that the isolated increase in water supply in the metro Atlanta area itself will not result in any significant change in state line flow. (See Slides 22 and 23.) When we look at the portion of the graph between the 80 and 95 percentiles exceedence, the curve resulting from Scenario B is only around 200 cfs below the curve resulting from the Baseline Condition. (See Slides 38 and 39.) This 200 cfs is

only 4% of the minimum flow requirement of 5,000 cfs, and less than 1% of the long term average simulated flow. At the very bottom of the duration curve, note that the RIOP's Drought Zone Operation will be triggered roughly 0.2% of the time under Scenario A and only 0.2% more often under Scenario B. Overall, the change in state line flow is minor in comparison to the magnitude of state line flow assuming the RIOP remains in place, and will likely remain so in any new operation plan that replaces the RIOP.

Enclosure

* * *

Rick Scott
Governor

September 6, 2012

Ms. Rebecca Blank
Acting Secretary
U.S. Department of Commerce
1401 Constitution Avenue, NW
Washington, D.C. 20230

Dear Secretary Blank:

On behalf of Florida's oyster industry, I respectfully request that you declare a commercial fishery failure due to a fishery resource disaster for Florida's oyster harvesting areas in the Gulf of Mexico, particularly those in Apalachicola Bay, pursuant to Section 312(a) of the Magnuson-Stevens Fishery Management and Conservation Act.

The State of Florida has experienced an unprecedented decline in the abundance of oysters within our coastal estuaries, a direct consequence of which has been a significant loss of income to commercial oyster fishermen, oyster processors and rural coastal communities. Recent oyster resource assessments indicate that the outlook for the 2012/2013 harvesting season is "poor" and unlikely to sustain commercial harvesting levels. I enclose a letter and report from Florida's Department of Agriculture and Consumer Services (FDACS) assessing the current impacts. The FDACS report estimates the dockside value of oyster landed in Franklin County at $6.64 million in 2011, which translates to a larger and significant overall economic impact to the affected communities. After conferring with county leadership, Franklin County estimates the em-

ployment impact to affect 2,500 jobs, including commercial oyster fishermen, processors and related coastal economies.

According to the report, observations and sampling of oyster populations on the primary oyster producing reefs in Apalachicola Bay during July 2012 indicated that oyster populations were in poor condition. It is believed that a combination of factors has led to the recent decline in oyster populations.

The Florida Panhandle and Apalachicola Bay, as the drainage basin of the Apalachicola, Flint, and Chattahoochee Rivers, have experienced drought conditions for several years resulting in reduced freshwater input into Apalachicola Bay. This absence of freshwater contributes to higher salinity levels adversely affecting oyster populations and contributing to mass natural mortality events and a dramatic increase in oyster predation.

Harvesting pressures and practices were altered to increase fishing effort, as measured in reported trips, due to the closure of oyster harvesting in contiguous states during 2010. This led to overharvesting of illegal and sub-legal oysters further damaging an already stressed population. Other undetermined causes may also have been involved.

Disaster relief funds authorized by the Magnuson-Stevens Act are needed to: 1) further assess the primary and secondary causes of the oyster decline; 2) determine the feasibility of actions to remediate or restore the affected resources; 3) begin actions to prevent and restore affected resources; and 4) provide economic assistance to fishing communities and small businesses, including oyster fishermen affected by the disaster.

The State of Florida is prepared to provide the information necessary for you to properly assess this situation. On behalf of Florida's oyster community, I thank you for your prompt consideration of this urgent request.

Sincerely,

/s/ Rick Scott
Rick Scott
Governor

Florida Department of Agriculture and Consumer Services
Commissioner Adam H. Putnam
The Capitol

September 5, 2012

The Honorable Rick Scott
Governor
State of Florida
The Capitol, Plaza Level 05
Tallahassee, Florida 32399

Dear Governor Scott:

I am writing today to advise you of a situation that is quickly becoming a crisis for Florida's coastal communities who rely on a vibrant and healthy oyster population for economic viability. The oyster resources in the state, particularly those in Apalachicola Bay, have been significantly impacted by the prolonged drought that many areas of the state are facing. The drought conditions in the Bay have caused the oyster resources to decrease to a level that will no longer sustain Florida's commercial oyster industry. This situation has been exacerbated by the low level of fresh water coming down the Apalachicola River into the Bay.

As you know, oysters require a delicate balance of both fresh and salt water. If salinity levels in and around oyster reefs get too high, the water is hospitable to marine organisms that prey on oysters such as oyster drills, stone crabs and conchs. In addition, high salinity creates unfavorable conditions for juvenile oyster growth. First with Tropical Storm Debby and followed shortly thereafter by Tropical Storm Isaac, the already scarce resource was further impacted. A recent assessment of the oyster resources in the Bay conducted by the Florida Department of Agriculture and Consumer Service (FDACS) concluded that current

oyster resource levels have not been this low since immediately after Hurricane Elena in 1985.

In addition to Apalachicola, we have already begun to hear from oyster harvesters in Wakulla, Dixie and Levy counties that they are also seeing high oyster mortality rates due to the drought. These areas have been closed seasonally to oyster harvesting through the summer and only opened on September 1, 2012. FDACS will conduct assessments on those areas over the next two weeks, however given the situation in Apalachicola Bay, it is likely these areas will also not support a sustained commercial harvest.

On behalf of Florida's oyster harvesters and processors, I respectfully request that you ask United States Department of Commerce Acting Secretary Rebecca Blank to declare a federal fishery disaster for Florida's oyster harvesting areas in the Gulf. I believe the current conditions meet the requirements established in Section 312(a) of the Magnuson-Stevens Fishery Conservation and Management Act and Section 308(b) of the Interjurisdictional Fisheries Act and therefore warrant this request.

To assist in your consideration of this request, I am enclosing the Apalachicola Bay Oyster Resource Assessment Report. Thank you in advance for your support of Florida's commercial oyster industry. Should you need additional information on this situation, please do not hesitate to contact me.

Sincerely,

/s/ Adam H. Putnam
Adam H. Putnam
Commissioner of Agriculture

Enclosure

# OYSTER RESOURCE ASSESSMENT REPORT
# APALACHICOLA BAY
# AUGUST 2012
# DEPARTMENT OF AGRICULTURE
# AND CONSUMER SERVICES
# DIVISION OF AQUACULTURE

## Executive Summary

Observations and sampling of oyster populations on the primary oyster producing reefs in Apalachicola Bay during July 2012 indicated that oyster populations were depleted over most of the reef areas sampled and that surviving oyster populations are severely stressed. Staff of the Department of Agriculture and Consumer Services' Division of Aquaculture conducted assessments of oyster populations after preliminary reconnaissance following the passage of Tropical Storm Debby indicated that oyster populations on Cat Point Bar and East Hole Bar were in poor condition. More detailed sampling and analyses confirmed the condition of oyster resources and suggested that the poor condition was the result of combination of environmental factors and fishery practices. Analyses and observations further suggested that Tropical Storm Debby was only a minor contributing factor to the overall poor condition of oyster resources and confirmed evidence that prolonged drought conditions, continuing low river discharge rates and intensive harvesting were adversely affecting oyster populations in Apalachicola Bay.

This report provides interpretative analyses of sampling data, fisheries data, environmental conditions, fishery practices and other factors to describe the current status of oyster resources and predict oyster fishery trends for the 2012/13 Winter Harvesting Season in Apalachicola Bay. Analyses and observations indicate

that a combination of factors have resulted in a cascading effect that has contributed to the depletion of oyster populations and may lead to longer-term debilitation of oyster resources and oyster reef habitats.

## Introduction

The Florida Department of Agriculture and Consumer Services (DACS) shares responsibility for managing oyster resources in Apalachicola Bay with the Florida Fish and Wildlife Conservation Commission (FWC); more specifically, the Division of Aquaculture manages oysters from both resource development and public health protection perspectives. This report summarizes information related to oyster resource compiled by the Division of Aquaculture from 2009 through August 2012.

## Oyster Fisheries Statistics

Since 1980, reported landings of oysters in Florida ranged from about 1 to 6.5 million pounds of meats: highest landings were reported in the early 1980s, around 6.5 million pounds. Apalachicola Bay accounts for about 90% of Florida's landings and about 9% of the landings from the Gulf of Mexico (2000-2008 average). Reported oyster landings from Apalachicola Bay for 2011 were approximately 2.4 million pounds of meat, representing a slight increase in landings from 2010 (Table 1).

In 2011, oystermen in Franklin County reported landings of 2,380,810 pounds of meats from 39,176 trips. Landings for Apalachicola Bay are higher than reported for Franklin County, because oystermen in neighboring counties may report landings from Apalachicola Bay in those counties.

Table 1. Oyster Landings in Apalachicola Bay, Florida

| Year | Pounds (Meats) | Number of Trips Reported | AB Oyster Harvesting Licenses | Bags/ Trip |
|---|---|---|---|---|
| 2000 | 2,327,402 | 25,550 | 958 | 13.9 |
| 2001 | 2,333,968 | 25,261 | 1,135 | 14.1 |
| 2002 | 1,725,776 | 20,294 | 914 | 13.0 |
| 2003 | 1,449,890 | 18,467 | 759 | 12.0 |
| 2004 | 1,502,056 | 17,692 | 719 | 12.9 |
| 2005 | 1,260,996 | 12,663 | 714 | 15.2 |
| 2006 | 2,127,049 | 22,644 | 916 | 14.3 |
| 2007 | 2,645,359 | 29,104 | 1,142 | 13.9 |
| 2008 | 2,238,482 | 27,603 | 1,168 | 12.3 |
| 2009 | 2,695,701 | 39,942 | 1,433 | 10.2 |
| 2010 | 1,938,059 | 32,330 | 1,909 | 9.1 |
| 2011 | 2,380,810 | 39,176 | 1,799 | 9.3 |
| 2012 | | | 1,687 | |

Landings per trip remained relatively stable during 2010 and 2011, ranging from 9.1 to 9.3 bags per trip. Landings per trip continued to trend downward from about 15 bags per trip in 2005 to about 9.3 bags per trip in 2011. Oyster landings and bags per trip do not show a direct correlation with the number of ABOHL sold; there were 1,799 ABHOL sold in 2011 and 1,687 sold in 2012. The dockside value of oyster landed in Franklin County was estimated at $6.64 million in 2011.

Oyster landings appear to be correlated with three primary variables; resource availability, fishing effort, and market demand. Fishing effort has increased while market demand has been highly variable due to economic instability, concerns associated with the Deep Water Horizon (DWH) oil spill incident in 2010, and inconsistent supplies from other Gulf states.

## Oyster Resource Assessments

The Division has conducted oyster resource surveys on the principle oyster-producing reefs in Apalachicola Bay since 1982. This information is used by resource managers to reliably predict trends in oyster production; to monitor oyster population dynamics, including recruitment, growth, natural mortality, standing stocks; and to determine the impacts of climatic events such as hurricanes, floods, and droughts on oyster resources. Sampling oyster populations allows resource managers to compare the relative condition of standing stocks over time using a denned sampling protocol. The Standard Oyster Resource Management Protocol (SORMP) provides a calculation to estimate production based on the density of legal size oysters collected during a defined sampling interval. Production estimates exceeding 400 bags of oysters per acre is applied as an indicator of healthy oyster reefs capable of sustaining commercial harvesting.

The Division of Aquaculture conducted oyster resource assessments on the commercially important oyster reefs in Apalachicola Bay during July 2012. Commercially important reefs included Cat Point Bar, East Hole Bar and the St. Vincent Bar and Dry Bar reef complex. Oyster resource assessments were also conducted on three recently rehabilitated reefs, and on shallow and intertidal reefs in St. Vincent Sound.

Production estimates for July 2012 from Cat Point Bar (287 bags/acre) and East Hole Bar (294 bags/acre) were the lowest production estimates reported in the past twenty years prior to the opening of the Winter Harvesting Season. Similarly, production estimates from St. Vincent Bar and Dry Bar (bags per acre) demonstrated depressed production estimates. Esti-

mated oyster population parameters for Cat Point Bar, East Hole Bar and St. Vincent / Dry Bar are below levels generally observed on these reefs prior to opening the Winter Harvesting Season, and suggest that stocks are not sufficiently abundant at this time to support commercial harvesting throughout the Winter Harvesting Season. Factors affecting estimated production parameters on individual reef complexes are discussed later in this report.

Cat Point Bar and East Hole Bar have historically been the primary producing reefs in Apalachicola Bay. These reefs form a contiguous reef system (except for the Intracoastal Waterway) that extends north to south across St George Sound and separates the sound from Apalachicola Bay. Over the past twenty years, landings from these reefs have been critical to supporting the oyster fishery in the region.

Oyster density and estimated production showed marked declines on Cat Point Bar when compared to 2011. Estimated production declined from 417 bags per acre in August 2011 to 287 bags per acre in July 2012 (Table 2). Oyster densities decreased substantially from 430 to 64 oysters per square meter over the same sampling interval (Table 2). The decrease in oyster density reflects poor recruitment, as well as severely reduced number of oysters in the juvenile size classes, and is indicative of the degraded quality of reef substrate and structure.

Cat Point and East Hole Bar have been subject to a combination of factors that have adversely affected oyster populations, oyster reef habitat, and the oyster fishery. Oyster populations over much of the reef area are depleted and the quality of the substrate is degraded to a point where spat settlement and recruitment

have been disrupted. Stress associated with prolonged high salinity, high natural mortality and predation, and intensive fishing effort have markedly reduced standing stocks of juvenile, sub adult and adult oysters.

The Dry Bar and St. Vincent Bar complex is a large contiguous reef system in western Apalachicola Bay. This reef complex provides a substantial portion of the Bay's landings during normal years, but fishing pressure was sporadic during 2011 and 2012. The estimated production for Dry Bar-St. Vincent (Table 2) indicated a substantial reduction from 323 bags per acre in August 2011 to 215 bags per acre in July 2012. Samples were collected from the Little Gully area on Dry Bar, because no live oysters were collected on St Vincent Bar. St. Vincent Bar, extending from Dry Bar southward was considered to be depleted of marketable oysters. The oyster population on St. Vincent Bar was likely decimated by stress associated with high salinity, disease and predation. Fishing pressure has declined as a result of reduced standing stocks of market-size oysters over the entire reef complex over the past two years. The current condition of oyster resources on Dry Bar is not expected to be at levels that will sustain commercial harvesting through the 2012/13 Winter Harvesting Season.

Estimated production parameters for the reef complexes in the western portion of the Bay and the "Miles" indicate that standing stocks of market size oysters are at various levels. Standing stocks on some reefs will support commercial harvesting, while other reefs show signs of severe stress and depletion. Oyster reefs, including North Spur, Green Point and Cabbage Lumps Plant Sites are in moderately good condition, with standing stocks and production at levels that will support limited commercial harvesting. These plant

sites have been planted with processed oyster shell within the last three years, and the substrate remains in good condition; size frequency distributions are typical of healthy oyster populations. However, these reefs are small and overall production will be limited. Also, oysters on these reefs will likely be subject to intense predation from rock snails, while salinity levels remain high. Oyster populations on shallow and intertidal reefs in the 'Miles' (Spacey's Flats, Eleven Mile Bar, Picolene Bar) are also severely stressed, showing signs of intense predation and natural mortality. Bars in northwestern Apalachicola Bay and eastern St. Vincent Sound, including Green Point, North Spur and Cabbage Lumps are more strongly influenced by river flows than bars located further away from the river mouth. Prevailing flows and circulation patterns move plumes of freshwater westward from the river over these reefs before they are dispersed throughout the Bay and St. Vincent Sound.

## The Standard Oyster Resource Management Protocol

Continuous monitoring and data analyses have allowed resource managers to develop a scale using defined sampling protocol to determine the relative condition of oyster resources based on estimated production parameters. The Standard Oyster Resource Management Protocol (SORMP) provides that estimated production exceeding 400 bags of oysters per acre is applied as an indicator of healthy oyster reefs capable of sustaining commercial harvesting. Accordingly, oyster populations are 1) capable of supporting limited commercial harvesting when stocks exceed 200 bags/acre, 2) below levels necessary to support commercial harvesting when stocks tall below 200 bags/acre, and 3) considered depleted when marketable stocks are below 100 bags/acre. Generally, production from Cat Point

Bar has been the most accurate indicator of oyster production in Apalachicola Bay, but East Hole Bar and St. Vincent Bar are also reliable indicators of the condition of oyster resources throughout the Bay. This scale forms the basis for the Standard Oyster Resource Management Protocol provided in Subsection 68B-27.017, Florida Administrative Code, which has been used as the criteria for setting the number of harvesting days in the Winter Harvesting Season in Apalachicola Bay.

## DEPLETION OF OYSTER RESOURCES

### Standing Stocks and Commercial Production Estimates

Size frequency distributions for oyster standing stocks are strong indicators of the health of oyster populations and are useful for predicting fishery trends. Size distributions among oyster populations are used to evaluate recruitment to the population, recruitment of juveniles to market size, growth, survival and potential production. Accordingly, size frequency distributions can be used to evaluate oyster depletion events. Current analyses of size frequency distributions and oyster standing stocks indicate that oyster populations on the major producing reefs in Apalachicola Bay are experiencing an on-going depletion event.

Oyster populations can be depleted from a number of factors; including climatic conditions, water quality, drought and flood events, catastrophic storms and hurricanes, natural mortality from diseases and predation, and fisheries. Most of the time, depletions occur because of a combination of these factors (multiple stressors).

Data analyses and observations on the major reef complexes showed substantial losses of oyster popula-

tions over the past two years, with severe declines in oyster densities, standing stocks and production estimates. Declining populations can be attributed to less than optimal environmental conditions (prolonged drought, reduced river discharge rates, nigh salinity), storm events (Tropical Storm Debby), and increased predation and natural mortality, weak recruitment, and extensive harvesting on the major reefs. It is evident from divers' observations that many reefs in Apalachicola Bay are showing the negative effects of decreased rainfall and freshwater flow rates from the Apalachicola River over the past two years, including depressed recruitment and increased natural oyster mortality (predation, disease, and stress associated with high salinity regimes). Additionally, the long-term impairment of reef structure (reef elevations, shell matrix, and shell balance) is of serious concern. Each of the factors contributing to oyster depletion in Apalachicola Bay are discussed below.

**Prolonged Drought and Elevated Salinity**

Adverse environmental conditions can have a devastating effect on oyster populations; and high salinity is among the most detrimental factors. Because oysters are sessile animals, they are not capable of moving when environmental conditions become less than optimal or sometimes lethal. While oysters can tolerate a wide range of salinities, prolonged exposure to less than optimal conditions will adversely impact affected populations. Oysters become physiologically stressed when salinity levels are below or above optimal levels (10-25 ppt) for extended periods, affecting reproductive potential, spatfall, recruitment, growth and survival.

Rainfall and concomitant river discharge are essential for productive oyster populations in Apalachicola

Bay, and provide three critical requirements for survival. First, survival depends upon salinity regimes that are suitable for oysters to reproduce, grow and survive. Rainfall in the drainage basin and discharge into the Bay are essential, as productive oyster populations require a combination for fresh water and marine waters. Fluctuating salinity regimes, within the oyster's tolerance limits, is the single most important factor influencing oyster populations in Apalachicola Bay. Second, rainfall, flooding in the flood plain, and river discharge into the Bay are essential for supplying nutrients and detritus necessary to nourish and sustain food webs and trophic dynamics within the estuarine system. And third, rainfall and river discharge is a critical factor driving fluctuations in salinity levels that prevent destructive predators with marine affinities from becoming established in the Bay. The critical influences of rainfall and river discharge were severely diminished during the past two years. The region and much of the drainage basin have been subject to extensive drought during 2011 and 2012, and these conditions have been reflected in low river stages and low river discharge rates.

Although, environmental conditions improved with relatively normal rainfall and river discharge in 2009 and early 2010, and abundant spat fall was reported on Cat Point and East Hole Bars during 2010, oyster resources have not rebounded completely. Conditions began to decline and drought conditions have persisted in the Apalachicola River Basin since August 2010. With drought conditions returning to the region, decreased rainfall and river discharge have contributed to stress on oyster populations in Apalachicola Bay.

The Florida Panhandle and the Apalachicola River (ACF) drainage basin have experienced prolonged

drought conditions for several years, and the reduced freshwater input into Apalachicola Bay has seriously affected oyster populations in the Bay. Poor recruitment and poor survival can be directly attributed to prolonged high-salinity environment, which is also confirmed by the presence of marine predators, primarily stone crabs and Florida rock snails (oyster drills). The predators are present in great numbers and are currently overwhelming oyster populations throughout Apalachicola Bay. Petes et al., (2012) and Wilber (1992) investigated the effects of reduced freshwater flows on oyster populations in Apalachicola Bay and reported adverse impacts resulting from low river flows.

Natural Mortality and Predation

The combination of high salinity and high water temperatures are known to severely stress oyster populations and may result in massive mortality events. It is highly likely that these environmental factors have contributed substantially to natural mortality and low recruitment in the Bay. High salinity and high water temperatures also correlate with the increased prevalence and intensity of the oyster parasite, *Perkinsus marinus*. This parasite (dermo) is often associated with oyster mortality in the hotter summer months and is commonly described as 'Summer Mortality Syndrome' in Florida. The Department participates in the Oyster Sentinel Program in the Gulf and monitors the presence and intensity of *P. marinus* in oysters in Apalachicola Bay.

Observations by divers confirmed the presence and abundance of stone crabs, *Menippe mercenaria*, on the primary oyster reefs in Apalachicola Bay. Stone crab burrows are easy to recognize and the appetite of these destructive predators is obvious. Stone crab burrows

are surrounded by living and dead oysters; the result of crabs actively foraging and bringing live oysters to their burrows. The shells of devoured oysters are also present and form a ring around burrows. Examining dead oyster shell provides confirmation of the crushing action of stone crabs on the shell of oysters. Stone crabs are considered primary predators of oysters when salinities remain high for extended periods and crab populations become established on oyster reefs.

Observations and sampling confirmed the presence and abundance of the Florida rock snail, *Stramonita haemastoma*, (formerly *Thais haemastoma*), a destructive snail commonly referred to as an oyster drill. Oyster drills are considered as one of the most serious oyster predators along Florida's Gulf Coast, and have become established in Apalachicola Bay over the past two years. Reports from oystermen suggest that drills are more abundant than at any time in recent memory. It appears that drill populations are moving farther into the estuary as oyster populations in the more marine portions of the Bay are depleted. High numbers of drills were found wherever viable oyster populations were observed. The presence and establishment of snail populations correlate with prolonged high salinity waters. It is also disturbing that drills are completing their life cycles within the estuary, since egg cases, juvenile, subadult and adult snails are abundant on oyster reefs.

Additionally, the Florida crown conch, *Melongena corona*, was commonly observed on oyster reefs. These conchs are also known to be serious oyster predators with marine affinities. Mud crabs of various species are also common predators on oyster reefs, generally attacking spat and smaller juvenile oysters.

Increased stress associated with high salinity regimes acts to exacerbate the level and intensity of predation by weakening oysters. Prolonged periods of high salinity result in natural mortality from predation which can have a significant impact on oyster populations and result in serious economic losses to commercial oyster fisheries. The presence and abundance of marine predators on oyster reefs in Apalachicola Bay the long duration of high salinity conditions within the estuary.

Harvesting Pressure

Declining oyster population parameters can be associated with harvesting, as well as environmental influences and natural mortality. Reported oyster landings for Franklin County in 2011 increased marginally over 2010 in both production and bags per trip, but harvesting pressure (as measured in reported trips) increased by about 20 percent. Oyster population parameters for Cat Point Bar and East Hole Bar suggest that oyster abundances and potential production is markedly depressed, possibly reflecting the effects of continuous harvesting, poor harvesting practices, as well as, less than optimal environmental conditions in 2010 and 2011. Over harvesting is most damaging when environmental conditions are less than optimal, recruitment is low, and natural mortality is high.

Resource managers believe that several activities associated with harvesting have had a detrimental impact on standing stocks and oyster resources on the primary producing reefs in St. George Sound in eastern Apalachicola Bay. The standing stocks of juvenile, sublegal, and market-size oysters suggest that the overall condition of many reefs has declined substantially over the past two years as a result of continuous harvesting

from Cat Point and East Hole Bars, concentrated and intensive harvesting by the majority of the fishing fleet, and the excessive harvesting of sub-legal oysters.

Vessel counts during the 2011/12 Winter Harvesting Season show that about 60 percent of the fishing fleet was concentrated on Cat Point and East Hole Bars. Fishing effort often averaged more than 120 vessels per day throughout 2011 and 2012 placing added pressure on Cat Point and East Hole Bars. In response to limiting the number of hours harvest can occur each day to control for *Vibrio vulnificus*, additional harvesting days during 2011 and 2012 were implemented which increased fishing pressure and further deteriorated the condition of the resource. Another contributing factor was the management decision to allow harvesting from these reefs during the summer of 2010 in response to the oil spill event (April, 2010). This resulted in an intense harvesting effort which precluded any recovery time for the resource

Harvesting pressure is usually high on reefs in the eastern portion of the Bay at the beginning of the oyster harvesting season, and in 2011 and 2012 harvesting pressure was almost exclusively directed to Cat Point and East Hole Bars. Harvesting pressure on Cat Point Bar and East Hole Bar in St. George Sound demonstrated an upward trend in effort over the past two years. This change in fishing effort is not easy to explain, since it does not seem to be strictly associated with resource availability. One plausible explanation may be the proximity of St George Sound to Eastpoint, where many licensed oystermen reside and sell their oysters.

Some of the decline of legal-size oysters can be attributed to the excessive harvesting of sub-legal oys-

ters. Since 2010, there have been numerous reports of oystermen harvesting oysters below the legal size limit and observations in the marketplace confirmed that the harvest of small oysters was very common during the DWH oil spill event and has persisted to the present. Excessive harvesting of sub-legal oysters from 2010 through 2012 reduced recruitment among sub-legal size classes to legal size, contributing to declining trends in estimated production in 2012/2013. This situation results from harvesting and culling practices of the fishermen, when sub-legal oysters are not culled and returned to the reef to grow to marketable size.

The practice of harvesting sub-legal oysters appears to be an extension of a "use it or lose it' attitude that prevailed during the fall and winter of 2010. Following the oil spill in April 2010, there was an acknowledged threat to oyster resources in Apalachicola Bay, and management policies were directed toward harvesting available resources in the face of a growing risk of loss. Throughout the period when oil posed an unpredictable threat to the oyster fishery, less effort was directed toward enforcing size limits, perhaps, yielding to the view that it would be more beneficial to harvest the available resource. But unfortunately, many oystermen have continued the same harvesting practices that were allowed during the oil spill threat.

The Division's 2011 *Oyster Resource Assessment Report for Apalachicola Bay* (Division of Aquaculture, 2011) stated that oyster population estimates indicated that recruitment would keep pace with harvesting pressure and sustain production throughout the 2011/12 Winter Harvesting Season: with the caveat that increased harvesting pressure and/or the unabated harvesting of sublegal stocks may alter the production / harvesting balance. In 2011, reports of the harvest and

sale of oysters below the legal size limit was still common practice, and it is now clear that there are not sufficient numbers of juvenile and market size oysters to support harvesting throughout the up coming season.

Tropical Storm Debby

Tropical Storm Debby made its closest approach to Apalachicola Bay on June 25, 2012 before moving eastward and making landfall near the mouth of the Suwannee River. Despite the fact that Debby never achieved hurricane strength, it was accompanied by moderate storm surge in the Big Bend region. Maximum surge at Apalachicola was 3.51 feet.

The greatest impacts to oyster reefs were expected to be in St George Sound and western Apalachicola Bay (St. Vincent Bar) because of the long fetch of open water. Scouring was expected as a result of storm surge and wave action across the Bay. Fortunately, most of the storm surge and strongest wave action occurred during high tides when the reefs are most protected from severe hydrological impacts.

Preliminary reconnaissance following T.S.Debby did not indicate severe disruption of oyster reef structure. Examination of shells and live oysters did not display the effects of severe scouring (ex. polished shell surfaces, abrasion, dead oysters) and observations by divers did not demonstrate extensive disruption of the reefs surface (suspension and deposition of reef shell and sediments, concretion of reef material, or burial of shell and living oysters). Although reef areas were sometimes devoid of live oysters, clusters of oysters were present in adjacent areas that did not indicate severe disturbance. Scouring and wave action may have impacted reef surfaces and oyster resources in some

areas, but widespread damage to reef structure was not observed.

Heavy rainfall and coastal flooding may have an adverse impact on oyster reefs closest to the river and distributaries in the river delta, but the sudden influx of freshwater did not appear to cause extensive oyster mortalities on reefs away from the river delta (reefs in the Winter Harvesting Areas). Preliminary reconnaissance and sampling did not identify oyster populations where mass mortalities occurred; it is generally apparent when a mass mortality event occurs from a freshet or poor water quality (low dissolved oxygen concentrations). However, it remains likely that oyster populations in close proximity to the river delta may be subject to prolonged low salinity and associated low dissolved oxygen concentrations, and may suffer mortalities. There have been some reports of recent mortalities (late July) among oysters on reefs in the Summer Harvesting Area (Norman's Lumps).

**Fishery Management Implications**

The Department of Agriculture and Consumer Services and the Fish and Wildlife Conservation Commission enacted several policies that allowed oystermen a greater opportunity to harvest available oyster resources in Apalachicola Bay in response to the Deepwater Horizon oil spill event and national shellfish program requirements. The Executive Director of the FWCC signed an Executive Order that allowed commercial harvest of oysters from Apalachicola Bay seven days a week beginning September 1, 2011, contingent upon the Standard Oyster Resource Management Protocol (SORMP). On June 1, 2012, the FWCC enacted rule amendments in Chapter 68B-27.017 that allowed harvesting of oysters seven days a week, year round in

Apalachicola Bay. This action was taken, in part, to accommodate commercial oyster fishermen for time on the water harvesting that was decreased as a result of recent management practices to enhance public health protection. These practices, consistent with national *Vibrio vulnificus* reduction criteria, imposed more stringent limitations on harvesting times from April through November.

Subsection 68B-27.017(1)(a), Florida Administrative Code, provides that oysters may be harvested for commercial purposes on any day of the week. Subsection (1)(b) provides that—If during the period of November 16 through May 31 DACS establishes that the oyster resources on Cat Point Bar and East Hole Bar can not sustain a harvest of 300 bags per acre (SORMP), then the harvest of oysters for commercial purposes shall be prohibited on Saturdays and Sundays. Results of the current assessment indicated mat estimated production on Cat Point Bar and East Hole Bar may not exceed the level provided in the SORMP for DACS to recommend that oyster harvesting for commercial purposes be continued at seven days a week. Oyster resources will be re-assessed in November and recommendations will be forwarded to the Florida Fish and Wildlife Conservation Commission.

FISHERY TRENDS

Analyses of oyster resource assessment data over the past two years indicate several general conclusions regarding oyster resources in Apalachicola Bay.

The outlook for oyster production for the 2012/2013 Winter Harvesting Season in St. George Sound (Cat Point, East Hole, Porters Bar and Platform) is described as "poor". It appears unlikely that oyster populations on Cat Point and East Hole Bars can sustain

concentrated harvesting effort throughout the Winter Harvesting Season.

Declining population estimates over the past two years generally indicated that oyster populations are severely stressed. Although oyster population parameters for 2010 and 2011 reflected relatively stable production estimates, declines in 2012 suggest that overall resource availability may not be capable of sustaining current harvesting levels (bags per trip). The number of bags per trip has continued to decline over the past five years.

Prior to 2009, the demand for oysters from Apalachicola Bay was a primary factor limiting harvests, as harvests did not appear to be limited by available stocks. Higher landings in 2009 likely reflected strengthening market demand and increased fishing effort rather than increased resource availability. However, in 2011/2012 demand for Apalachicola Bay oysters increased because of reduced production from historically productive areas in other Gulf states, while oyster resources in the Bay have suffered during the current drought. Consequently, oyster resources may not be adequate to support increased harvesting pressure and meet increased demand throughout the upcoming season.

Table 2. Cat Point Bar Population Estimates: September 2008 to July 2012.

| Sample | | Oyster | Mean | Density | Oysters | | | | Bags |
|---|---|---|---|---|---|---|---|---|---|
| Date | Quadrat (0.25m) | Number (n) | Leng. (mm) | (/m) | >50mm (%) | >75mm (%) | (/m) | 1000X (/ac) | (/ac) |
| 09/08 | 20 | 616 | 55.2 | 123.2 | 66.2 | 17.21 | 212 | 85.8 | 381 |
| 11/08 | 10 | 564 | 52.0 | 225.6 | 55.7 | 19.33 | 43.6 | 176.4 | 784 |
| 12/08 | 10 | 333 | 56.9 | 133.2 | 66.1 | 24.92 | 33.1 | 134.3 | 597 |
| 08/09 | 20 | 828 | 50.1 | 165.6 | 49.9 | 15.10 | 25.0 | 101.1 | 449 |
| 11/09 | 10 | 626 | 48.2 | 250.4 | 50.2 | 7.83 | 19.6 | 79.3 | 352 |
| 04/10 | 20 | 969 | 48.4 | 193.8 | 46.7 | 9.91 | 19.2 | 77.7 | 345 |
| 08/10 | 20 | 1,043 | 50.5 | 208.6 | 53.9 | 8.92 | 18.6 | 75.3 | 334 |
| 11/10 | 20 | 865 | 52.8 | 173.0 | 63.7 | 12.25 | 21.2 | 85.7 | 381 |
| 08/11 | 15 | 1,611 | 48.2 | 429.6 | 48.5 | 5.40 | 23.2 | 93.9 | 417 |
| 07/12 | 10 | 161 | 58.8 | 64.4 | 67.1 | 24.84 | 15.9 | 64.7 | 287 |

Table 2. East Hole Bar Population Estimates: November 2008 to July 2012.

| Sample | | Oyster | Mean | Density | Oysters | | | | Bags |
|---|---|---|---|---|---|---|---|---|---|
| Date | Quadrat (0.25m) | Number (n) | Leng. (mm) | (/m) | >50mm (%) | >75mm (%) | (/m) | 1000X (/ac) | (/ac) |
| 11/08 | 10 | 318 | 57.5 | 127.2 | 69.1 | 22.33 | 28.4 | 114.9 | 510 |
| 09/09 | 20 | 1,023 | 49.3 | 204.6 | 50.7 | 9.09 | 18.5 | 75.2 | 334 |
| 11/10 | 10 | 682 | 47.0 | 272.8 | 48.6 | 9.38 | 25.6 | 103.6 | 460 |
| 07/12 | 10 | 127 | 60.8 | 50.8 | 65.3 | 32.28 | 16.3 | 66.3 | 294 |

Table 2. Dry Bar Population Estimates: September 2008 to July 2012.

| Sample | | Oyster | Mean | Density | Oysters | | | | Bags |
|---|---|---|---|---|---|---|---|---|---|
| Date | Quadrat (0.25m) | Number (n) | Leng. (mm) | (/m) | >50mm (%) | >75mm (%) | (/m) | 1000X (/ac) | (/ac) |
| 09/08 | 20 | 1,467 | 54.0 | 293.4 | 64.1 | 14.86 | 43.6 | 176.4 | 784 |
| 12/08 | 10 | 986 | 47.1 | 394.4 | 49.8 | 7.81 | 30.8 | 124.6 | 554 |
| 08/09 | 20 | 1,353 | 46.6 | 272.6 | 41.2 | 6.31 | 17.2 | 69.6 | 309 |
| 11/09 | 10 | 589 | 45.6 | 235.6 | 41.7 | 7.13 | 16.7 | 67.9 | 302 |
| 08/10 | 20 | 877 | 50.2 | 175.4 | 50.5 | 10.83 | 18.9 | 76.8 | 341 |
| 11/10 | 20 | 1,313 | 43.1 | 262.5 | 34.4 | 11.65 | 30.5 | 123.8 | 550 |
| 08/11 | 15 | 567 | 47.5 | 151.2 | 44.8 | 11.90 | 17.9 | 72.7 | 323 |
| 07/12 | 10[a] | 150 | 56.0 | 60.0 | 66.0 | 20.0 | 12.0 | 48.6 | 215[a] |

a - Samples collected from Little Gully on Dry Bar. No live oysters were collected from St. Vincent Bar

Table 2. North Spur (Plant) Population Estimates: September 2008 - July 2012.

| Sample | | Oyster | Mean | | Oysters | | | | Bags |
|---|---|---|---|---|---|---|---|---|---|
| Date | Quadrat (0.25m) | Number (n) | Leng. (mm) | Density (/m) | >50mm (%) | >75mm (%) | (/m) | 1000X (/ac) | (/ac) |
| 09/08 | 5 | 284 | 52.9 | 227.2 | 60.6 | 10.56 | 23.9 | 97.0 | 431 |
| 09/09 | 10 | 541 | 49.5 | 216.4 | 49.9 | 12.75 | 27.5 | 111.6 | 496 |
| 04/10 | 5 | 1040 | 48.0 | 832.0 | 50.4 | 5.10 | 42.4 | 171.7 | 763 |
| 08/11 | 5 | 269 | 52.9 | 215.2 | 58.0 | 15.99 | 34.4 | 139.2 | 619 |
| 07/12 | 10 | 362 | 53.4 | 144.8 | 57.5 | 18.23 | 26.4 | 106.8 | 475 |



Table 2. Green point (Plant) Population Estimates: September 2008 - July 2012.

| Sample | | Oyster | Mean | | Oysters | | | | Bags |
|---|---|---|---|---|---|---|---|---|---|
| Date | Quadrat (0.25m) | Number (n) | Leng. (mm) | Density (/m) | >50mm (%) | >75mm (%) | (/m) | 1000X (/ac) | (/ac) |
| 09/08 | 10 | 482 | 58.8 | 192.2 | 75.9 | 20.33 | 39.2 | 158.6 | 705 |
| 09/09 | 10 | 274541 | 48.2 | 109.6 | 44.1 | 17.52 | 19.2 | 77.7 | 345 |
| 09/11 | 10 | 510 | 54.4 | 204.0 | 65.5 | 12.94 | 26.4 | 106.5 | 474 |
| 07/12 | 5 | 125 | 59.6 | 100.0 | 65.0 | 28.00 | 28.0 | 113.3 | 503 |